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*bulletin of*  
**Duke University**  
**1989-90**

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*Undergraduate Instruction*





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**Duke University**  
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*Undergraduate Instruction*

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# University Calendar—1989-90

## Summer 1989\*

<b>April</b>		
3	Monday	—Beginning of registration for Term I and/or Term II
<b>May</b>		
9	Tuesday	—Beginning this day, summer Drop/Adds must be approved by the academic dean or director of graduate studies
10	Wednesday	—Last day for registration and payment of Term I fees without \$25 late fee (before 4:30 P.M.)
18	Thursday	—Term I classes begin
22	Monday	—Drop/Add for Term I ends at 4:00 P.M.
<b>June</b>		
26	Monday	—Last day for registration and payment of Term II fees without \$25 late fee (before 4:30 P.M.)
30	Friday	—Term I final examinations begin
<b>July</b>		
1	Saturday	—Term I final examinations end
5	Wednesday	—Term II classes begin
7	Friday	—Drop/Add for Term II ends at 4:00 P.M.
<b>August</b>		
17	Thursday	—Term II final examinations begin
18	Friday	—Term II final examinations end

## Fall 1989

<b>August</b>		
24	Thursday	—Orientation begins; assemblies for all new undergraduate students
28	Monday, 8:00 A.M.	—Fall semester classes begin
29	Tuesday, 4:00-6:00 P.M.	—Drop/Add begins, Intramural Building
30-31	Wednesday-Thursday, 8:30 A.M.-12:30 P.M. and 2:00-4:00 P.M.	—Drop/Add continues, 103 Allen Building
<b>September</b>		
1	Friday, 8:30 A.M.-12:30 P.M. and 2:00-4:00 P.M.	—Drop/Add continues, 103 Allen Building
4	Monday	—Labor Day, classes in session
5-8	Tuesday-Friday, 8:30 A.M.-12:30 P.M. and 2:00-4:00 P.M.	—Drop/Add continues, 103 Allen Building
<b>October</b>		
13	Friday	—Last day for reporting midsemester grades
13	Friday, 6:00 P.M.	—Fall break begins
18	Wednesday, 8:00 A.M.	—Classes resume
27-29	Friday-Sunday	—Parents' Weekend
<b>November</b>		
6-9	Monday-Thursday	—Registration for spring semester, 1990
10-12	Friday-Sunday	—Homecoming
22	Wednesday, 12:30 P.M.	—Thanksgiving recess begins
27	Monday, 8:00 A.M.	—Classes resume
<b>December</b>		
7	Thursday, 6:00 P.M.	—Fall semester classes end
8-10	Friday-Sunday	—Reading period
10	Sunday	—Founders' Day
11	Monday	—Final examinations begin
16	Saturday	—Final examinations end

\*The School of Forestry, the Fuqua School of Business, the Marine Laboratory, the Graduate Nursing Program, and Physical Therapy may have different starting dates during the summer; consult the appropriate bulletins and schedules.

## Spring 1990

### January

- 8 Monday—Orientation begins  
10 Wednesday—Registration and matriculation of new undergraduate students  
11 Thursday, 9:00 A.M.—Spring semester classes begin  
12 Friday, 4:00-6:00 P.M.—Drop/Add begins, Intramural Building  
15-19 Monday-Friday, 8:30 A.M.-12:30 P.M. and 2:00-4:00 P.M.—Drop/Add continues, 103 Allen Building  
22-24 Monday-Wednesday, 8:30 A.M.-12:30 P.M. and 2:00-4:00 P.M.—Drop/Add continues, 103 Allen Building

### February

- 23 Friday—Last day for reporting midsemester grades

### March

- 9 Friday, 6:00 P.M.—Spring recess begins  
19 Monday, 8:00 A.M.—Classes resume

### April

- 2-4 Monday-Wednesday—Registration for fall semester, 1990 and beginning of registration for summer, 1990  
25 Wednesday, 6:00 P.M.—Spring semester classes end  
26-29 Thursday-Sunday—Reading period  
30 Monday—Final examinations begin

### May

- 5 Saturday—Final examinations end  
11 Friday—Commencement begins  
13 Sunday—Graduation exercises. Conferring of degrees





# University Administration

## GENERAL ADMINISTRATION

H. Keith H. Brodie, M.D., LL.D., *President*  
Phillip A. Griffiths, Ph.D., *Provost*  
Ralph Snyderman, M.D., *Chancellor for Health Affairs and Dean of the Medical School*  
Eugene J. McDonald, LL.M., *Executive Vice-President*  
William G. Anlyan, M.D., D.Sc., *Chancellor*  
Joel L. Fleishman, LL.M., *Senior Vice-President*  
J. Peyton Fuller, A.B., *Vice-President, Planning and Treasurer*  
William J. Griffith, A.B., *Vice-President for Student Affairs*  
John J. Piva, Jr., B.A., *Senior Vice-President for Alumni Affairs and Development*  
Patricia C. Skarulis, M.A., *Vice-President for Information Systems*  
Andrew G. Wallace, M.D., *Vice-President for Health Affairs*  
John F. Adcock, M.B.A., *Vice-President and Corporate Controller*  
Tom A. Butters, B.A., *Vice-President and Director of Athletics*  
N. Allison Haltom, A.B., *Secretary of the University*

## GENERAL ACADEMIC ADMINISTRATION

Phillip A. Griffiths, Ph.D., *Provost*  
S. Malcolm Gillis, Ph.D., *Vice-Provost for Academic Affairs and Dean of the Graduate School*  
Charles E. Putman, M.D., *Vice-Provost for Research and Development*  
Thomas A. Langford, Ph.D., *Vice-Provost for Special Projects*  
Margaret Bates, Ph.D., *Vice-Provost for Academic Programs and Facilities*  
Paula Burger, Ph.D., *Vice-Provost for Academic Services*  
Jerry D. Campbell, Ph.D., *Vice-Provost for Library Affairs and University Librarian*  
Judith Ruderman, Ph.D., *Director of Continuing Education*  
Calvin Ward, Ph.D., *Assistant Provost for Academic Facilities and Director of the Summer Session*  
Albert F. Eldridge, Ph.D., *Assistant Provost and University Registrar*  
Melissa Mills, M.B.A., *Assistant Provost*  
Susan MacDonald, M.A., *Assistant Provost*

## Arts and Sciences and Trinity College

Richard A. White, Ph.D., *Dean*  
Thomas A. Spragens, Ph.D., *Associate Dean*  
Charles W. Byrd, Jr., Ph.D., *Assistant Dean for Academic Affairs*  
Thomas D. Mann, A.B., *Assistant Dean for Administration*  
Lee W. Willard, Ph.D., *Assistant Dean for Planning and Development*

## Trinity College

Gerald L. Wilson, B.D., Ph.D., *Senior Associate Dean*  
Martina J. Bryant, Ed.D., *Associate Dean*  
Elizabeth S. Nathans, Ph.D., *Associate Dean and Director of the Premajor Advising Center*  
Mary Nijhout, Ph.D., *Associate Dean and Director of Health Professions Advising Center*  
Ellen W. Wittig, Ph.D., *Associate Dean*  
Caroline L. Lattimore, Ph.D., *Assistant Dean*  
Deborah A. Roach, Ph.D., *Assistant Dean*  
Robert P. Weller, Ph.D., *Assistant Dean*

## School of Engineering

Earl H. Dowell, Sc.D., *Dean*  
Jack B. Chaddock, Sc.D., *Associate Dean for Research and Development*  
Marion L. Shepard, Ph.D., *Associate Dean for Academic Affairs*

## Student Affairs

William H. Willimon, M.Div., STD, *Minister to the University*  
Nancy Ferree-Clark, M.Div., *Associate Minister to the University*  
Jane Clark Moorman, M.S.W., ACSW, *Director, Counseling and Psychological Services*  
Susan L. Coon, M.A., *Director, Office of Cultural Affairs*  
Carlisle C. Harvard, B.A., *Director, International House*



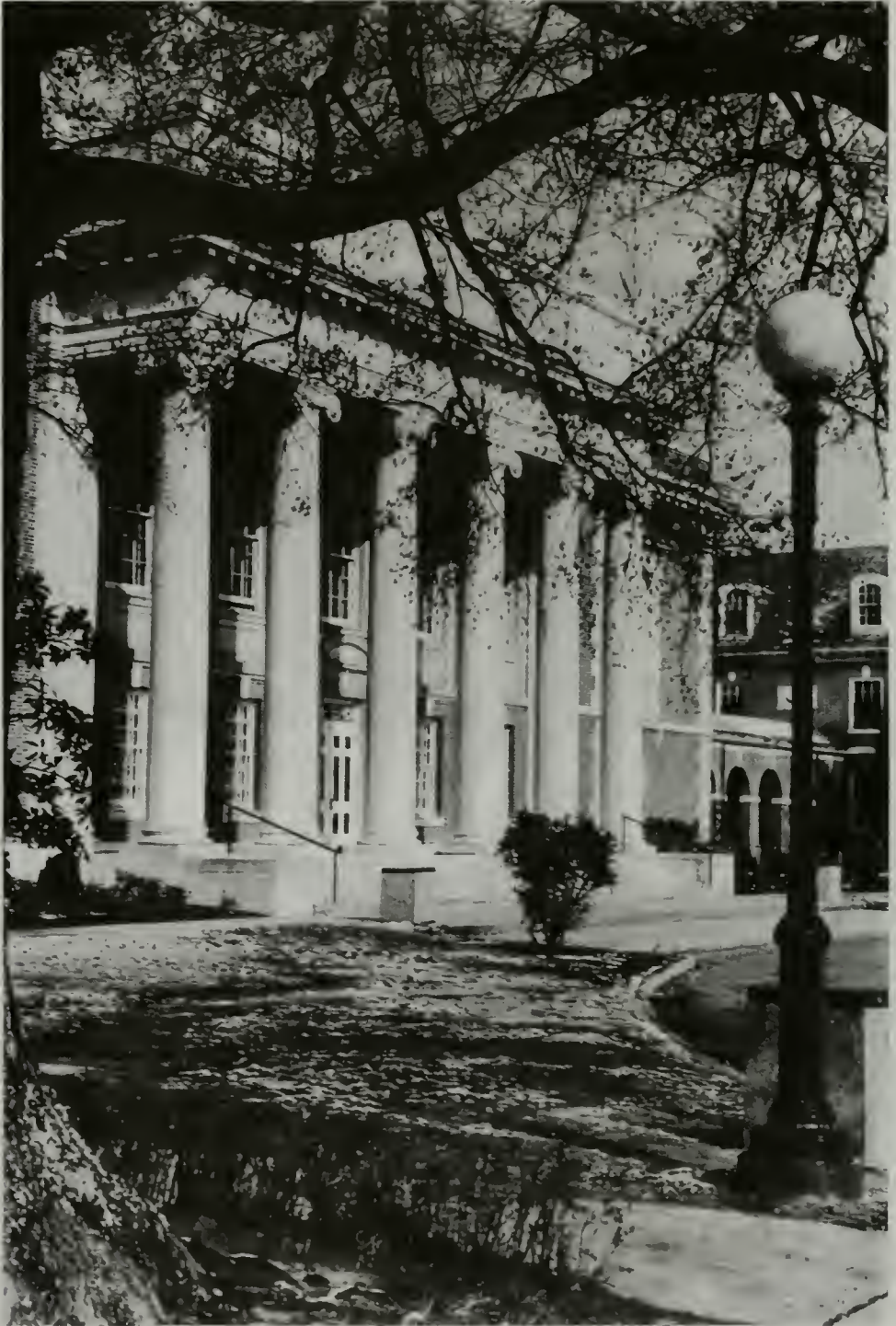
Caroline L. Lattimore, Ph.D., *Dean for Minority Affairs*  
Edward S. Hill, Ph.D., *Director, Mary Lou Williams Center for Black Culture*  
Laurence P. Maskel, Ph.D., *Acting Director, Placement Services*  
Richard L. Cox, B.D., Ed.D., *Dean for Residential Life*  
Ella E. Shore, M.A., *Associate Dean for Residential Life*  
Homai McDowell, D.B.A., *Director, Office of Student Activities*  
Howard J. Eisenson, M.D., *Director of Student Health*  
Suzanne Wasiolek, M.H.A., *Dean for Student Life*  
Jake Phelps, B.A., *Director, University Union*  
Peter J. Coyle, Jr., B.A., *Associate Director, University Union*

## **Admissions and Financial Aid**

Richard Steele, Ph.D., *Director of Undergraduate Admissions*  
James A. Belvin, Jr., A.B., *Director of Undergraduate Financial Aid*



*General Information*



## Duke University

In 1839 a group of citizens from Randolph and adjacent counties in North Carolina assembled in a log schoolhouse to organize support for a local academy founded a few months earlier by Brantley York. Prompted, they said, by “no small share of philanthropy and patriotism,” they espoused their belief that “ignorance and error are the banes not only of religious but also civil society which rear up an almost impregnable wall between man and happiness.” The Union Institute, which they then founded, was reorganized in 1851 as Normal College to train teachers, and again in 1859 as Trinity College, a liberal arts college, which later moved from the fields of Randolph County to the growing city of Durham, North Carolina. Trinity College was selected by James B. Duke as the major recipient of a fortune when, in 1924, he provided endowment funds for the university that would be organized around Trinity College and named for the Duke family.

The old Trinity College had, like almost all institutions in America at the time it was founded, been restricted to men. In 1896, Washington Duke gave an endowment with the condition that women be admitted “on equal footing with men.” Thereafter, women were educated in Trinity College, and in 1930 the Woman’s College was established as a separate college. Trinity College and the Woman’s College continued as coordinate colleges for over forty years. To assure that women were indeed admitted “on equal footing with men,” and to recognize that the education which men and women had received at Duke had long taken place in the same classrooms, the University merged these coordinate colleges in 1972 to form Trinity College of Arts and Sciences, the liberal arts undergraduate college of the University. The Bachelor of Arts and Bachelor of Science degrees may be earned in the college.

Instruction in engineering started at Normal College in 1851 and was continued at Trinity College as an option in the arts and sciences program. A Department of Engineering was established at Trinity in 1910. Following the establishment of Duke University in 1924, the Departments of Civil and Electrical Engineering were formed in 1927, and a Department of Mechanical Engineering was added four years later. The three engineering departments were joined to form the Division of Engineering as a separate administrative unit of the University. In 1939 this division was renamed the College of Engineering, which in 1966 became a professional school of engineering. The Division of Biomedical Engineering was added to the School of Engineering in 1967, and it was recognized as a department in 1971. In 1974 the name of the mechanical engineering department was changed to the Department of Mechanical Engineering and Materials Science; in 1982, the Department of Civil Engineering was renamed the Department of Civil and



Environmental Engineering. All four departments offer courses leading to Bachelor of Science in Engineering, Master of Science, and Doctor of Philosophy degrees.

The School of Nursing was established in 1931 in association with the School of Medicine and Duke Hospital. From 1944 until 1984, the Bachelor of Science in Nursing Education degree was offered. In 1980, the University Board of Trustees approved the phaseout of the existing undergraduate degree programs. At present, the School of Nursing offers courses leading to the Master of Science in Nursing degree, a program initiated in 1958.

As the University developed around the core of undergraduate colleges and schools, the Graduate School expanded in areas of instruction and research. The School of Law of Trinity College became the Duke University School of Law, and other professional schools were established. The Divinity School was organized in 1926, the School of Medicine in 1930, the School of Forestry in 1938, and the Graduate School of Business Administration in 1969. In 1974, the School of Forestry was renamed the School of Forestry and Environmental Studies; in 1980 the business school became the Fuqua School of Business. The Graduate School itself, as distinguished from these professional schools, was organized in the 1920s. It now consists of some fifty-five departments and programs, and offers A.M., M.S., M.H.A., and Ph.D. degrees.

Duke, a privately supported, church-related (Methodist) university, has over 9,000 students enrolled in degree programs. These students represent nearly every state and many foreign countries; Duke has more than 60,000 alumni in all fifty states and in many foreign countries. The University is a member of the North Carolina Association of Independent Colleges and Universities, the Southern Association of Colleges and Schools, and the Association of American Universities.

From academy to university, some of the basic principles have remained constant. The Duke University motto, *Eruditio et Religio*, reflects a fundamental faith in the union of knowledge and religion, the advancement of learning, the defense of scholarship, the love of freedom and truth, a spirit of tolerance, and a rendering of the greatest service to the individual, the state, the nation, and the church. Through changing generations of students, the objective has been to encourage individuals to achieve, to the extent of their capacities, an understanding and appreciation of the world in which they live, their relationship to it, their opportunities, and their responsibilities.

## Resources of the University

**The Faculty.** The University faculty, approximately 1,500 along with 1,700 adjunct and clinical faculty, maintains a tradition of personal attention to students and devotion to research. Many members of the faculty are, and have been, cited for excellence in teaching and are elected to membership in the national societies which honor those best in scholarship and research. Leaders in their disciplines and their professional organizations, they are authors of significant books and articles. Members of the faculty also act as consultants to industry, government, and foundations. To honor its outstanding faculty, the University has established more than seventy James B. Duke and other named professorships.

**The Library System.** The libraries of the University consist of the William R. Perkins Library and its seven branches on campus: Biology-Forestry, Chemistry, Divinity, East Campus, Engineering, Music, Mathematics-Physics; the Pearse Memorial Library at the Duke Marine Laboratory in Beaufort; and the independently administered libraries of Law, Medicine, and Business (Fuqua). In June 1988, these libraries contained approximately 3,668,935 volumes. More than 8,958 periodicals, 9,685 serials, and 222 newspapers are received regularly. The collection includes about 2,685,206 manuscripts, 1,279,898 microforms, and over 2,000,000 public documents.

*The William R. Perkins Library.* The William R. Perkins Library, the main library of the University, houses most of the books and journals in the humanities and social sciences,

large files of United States federal and state documents, public documents of many European and Latin American countries, publications of European academies and learned societies, and special collections from South Asian, Far Eastern, and Slavic countries. The newspaper collection, with nearly 535,000 microform pieces, has several long eighteenth-century files; strong holdings of nineteenth-century New England papers; and antebellum and Civil War papers from North Carolina, South Carolina, Virginia, and Georgia; as well as many European and Latin American papers. The manuscript collection of approximately 2.6 million items is particularly strong in all phases of the history, politics, and social and economic life of the South Atlantic region; it also includes significant papers in English and American literature and the J. Walter Thompson Advertising Archives. The rare books collection contains many scarce and valuable materials covering a broad range of fields, and the Latin and Greek manuscripts constitute one of the outstanding collections of its kind in the United States. The collection of Confederate imprints is one of the largest in the country.

The Undergraduate Library houses the required reading materials placed on reserve for most graduate and undergraduate courses as well as the library's audiovisual collection of films, audio and disk recordings, and videocassettes. The branch libraries serve the academic disciplines whose names they bear. The East Campus Library is primarily for undergraduate use, but it also contains the principal collections for graduate and undergraduate study in art and the performing arts.

Reference librarians are on duty in Perkins Library for most of the hours the library is open. Their primary responsibility is to assist patrons in making the most effective use of library collections and facilities. In addition to answering specific questions, the reference librarians also help patrons access information by identifying and explaining the use of library sources and by giving formal and informal library instruction to groups of students, faculty, or staff. Professional reference service is available to students in all other campus libraries.

Tours of the Perkins Library are given frequently during Orientation Week and upon request throughout the year. Information about other campus libraries may be obtained from the staff in each of the libraries. Handbooks about library services and facilities are also available in each of the libraries.

To protect the collections of Perkins Library for the benefit of all members of the University community, electronic security systems are in operation at the main exit and at the periodicals exit. Desk attendants are authorized to examine all books and other library materials that people using the library may be carrying in hands, briefcases, or bags to determine if they are properly charged. Anyone who refuses to permit books to be examined may be denied further use of the library.

The library has microfilming and copying services. The rules with regard to copyright and a schedule of fees for reproduction services are available in the library at the point of service.

*The Medical Center Library.* The Medical Center Library, located in the Seeley G. Mudd Communications Center and Library Building, provides the services and collections necessary to further educational, research, and clinical activities in the medical field. Services are available to the students, faculty, and staff of the School of Medicine; of the Division of Allied Health; of Duke Hospital; and of the graduate departments in the basic medical sciences. Other students and faculty needing access to biomedical literature may apply for privileges upon application to the Head of the Circulation Department.

Over 232,000 volumes are available, including the Trent Collection in the History of Medicine. Approximately 2,650 journal subscriptions are received currently, in addition to extensive back files of older materials. The library has several types of audiovisual materials and equipment. With the exception of certain items shelved on reserve, these materials have been integrated into the general book and journal collections and are listed in the card or journal catalogs. The Frank Engel Memorial Collection consists of a small group of books on nonmedical subjects for general reading, together with several

newspapers and popular magazines. Traditional reference services are supplemented by on-line bibliographic systems and computer-produced specialized indexes.

The uniform borrowing privileges apply to all registered users. Details of loan and other services may be found in the guide which is published each year and is available at the library.

*The School of Law Library.* The School of Law Library, with over 370,000 volumes, serves both the University and the local legal community. It features comprehensive coverage of basic Anglo-American primary source materials, including nearly all reported decisions of federal and state courts, as well as current and retrospective collections of federal and state codes and session laws. Digests, legal encyclopedias, and other indexing devices provide access to the primary documents. A large section of the library collection is devoted to treatises on all phases of law and legal sciences, as well as history, economics, government, and other social and behavioral sciences relevant to legal research. The treatises are organized in the Library of Congress classification system and most are accessible through the Duke University online catalog. Special treatise collections are maintained in several subject areas, including the George C. Christie collection in jurisprudence and the Floyd S. Riddick collection of autographed senatorial material. The library is a selective depository for United States government publications, with concentration on congressional and administrative law materials. The library receives the records and briefs from the United States Supreme Court, the Fourth Circuit Court of Appeals, and the North Carolina Supreme Court and Court of Appeals. In addition to its Anglo-American holdings, the library holds substantial research collections in foreign and international law. The foreign law collection is extensive in coverage, with concentrations in European law and business law materials. The international law collection is strong in primary source and treatise material on both private and public international law topics. Undergraduate and graduate students whose course of study requires access to legal literature may use the library. However, access to the library may be restricted during certain times because of accreditation standards.

**Record Library.** The Department of Music has a record library separate from the university libraries with facilities for listening to records and tapes. All materials may be used in the listening room and any member of the community may borrow from the Arts Council Collection of more than 2,700 records for a nominal fee.

**University Archives.** The Duke University Archives, the official archival agency of the University, collects, preserves, and administers the records of the University having continuing administrative or historical value. The institutional archives, which also include published material, photographs, papers of student groups and faculty, and selected memorabilia, are available for research under controlled conditions in 341 Perkins Library.

**Computation Center.** For a contemporary university, extensive computing resources are essential. At Duke, the Center for Academic Computing is the organization that works in partnership with members of the University community to enable them to achieve their goals through computing.

The Center for Academic Computing provides access to a variety of computing facilities and services. Through Duke's connection to the National Science Foundation data network, students can get access to an IBM 3090-600S at the Cornell National Supercomputer Facility, a Cray X-MP/48 at the Pittsburgh Supercomputer Center, and in 1989, to the Cray Y-MP/432 at the North Carolina Supercomputing Center. Mainframe service for Duke is provided on an IBM 3081 computer at the Triangle Universities Computation Center (TUCC) located in the Research Triangle Park. TUCC is a regional computer center formed and operated jointly by North Carolina State University at Raleigh, the University of North Carolina at Chapel Hill, and Duke University. Minicomputer service is provided by departmentally owned systems, including Digital and Sun equipment, and by three AT&T 3B-15s operated by the Center for Academic Computing.



Access to these supercomputer, mainframe, and minicomputer systems is provided by campus facilities connected by telecommunications links. These include public clusters of AT&T 4425 terminals located on the West, East, and North campuses. In addition, anyone with a personal computer, modem, and telephone line can connect to these computers by dialing into a central dataswitch. Printing services are available through four medium speed printers located on East and West campuses, and TUCC printing can use the high speed Xerox 9700 laser printer located in North Building.

The Center for Academic Computing also supports extensive personal computer services located throughout the campus. There are three laboratories of MS-DOS based personal computers housed in the North, Engineering, and Carr buildings, and nine public clusters of both MS-DOS and Apple Macintosh personal computer systems spread throughout the University. All laboratories and clusters are equipped with either dot matrix or laser printing facilities, and several are connected to the campus telecommunications network. While there is a nominal charge for the use of the laser printers, there is no charge for the use of the personal computers.

Funds for using TUCC come from outside grants and contracts, and from University funds. Several schools within the University, such as Arts and Sciences and Engineering, may apply for funding specifically designated for use at TUCC. Faculty within these schools automatically have access to a TUCC account. Graduate students in these schools may apply for a TUCC account. Any student may request a free account for electronic mail services. More specific information regarding Duke computing facilities may be obtained by contacting the Center for Academic Computing Consulting Desk at 684-3695, 9:00 A.M. to 5:00 P.M., Monday through Friday.

**Science Laboratories.** In addition to the teaching and research laboratories in the departments of natural and social sciences and in the School of Engineering, there are other facilities in which some advanced undergraduates work on individual projects. These include the Duke University Marine Laboratory in Beaufort, North Carolina; the phytotron of the Southeastern Plant Environment Laboratories, located on the Duke campus; the Duke Forest, adjacent to the campus; the Duke University Primate Center in Duke Forest; and the Triangle Universities Nuclear Laboratory, also on the campus.

## Duke as a Residential University

Duke has a long tradition as a residential university and has sought to provide for the great majority of the undergraduates convenient on-campus housing in both residence halls and apartments. While the University was established to provide a formal educational opportunity for students, Duke has always taken the position that education encompasses social and personal development as well as intellectual growth. In order to facilitate such a holistic approach, Duke seeks to provide a supportive environment substantially anchored in its residential program.

Educational, cultural, and outdoor adventure programming is planned and presented throughout the year for living groups through the cooperative work of the Office of Residential Life, Trinity College of Arts and Sciences, the School of Engineering, and resident students. There are a number of faculty members in residence in both freshman and upperclass houses. Faculty offices and seminar rooms are also located in several houses. The goals of these various programs are to enhance the quality of intellectual and social life for the residents on campus, to facilitate student-faculty interaction outside of the formal classroom, and to develop a greater sense of community within the individual residence halls as well as within the greater University.

## The Undergraduate College and School

In Trinity College of Arts and Sciences and the School of Engineering, instruction is offered by University faculty who engage in research and in graduate and undergraduate

teaching. Duke offers its undergraduates the opportunity to study with many internationally recognized authorities in their disciplines and with faculty members who are jointly committed to undergraduate instruction and to the advancement of knowledge. The University recognizes that students learn not only through formal lectures, but also through the interplay of ideas among faculty members and students; thus, it offers undergraduates opportunities to test their ideas against those of their professors and to observe at close range those who have committed their lives to academic careers.

The University, if it is doing its job properly, is educating citizens of the United States and of the world, not only individuals aspiring to personal fulfillment. At Duke, the men and women who earn degrees are likely to become leaders in industry, government, and the professions. They will have influence on and will be influenced by the social fabric of which they are a part. The kind of people they become will matter not only to them and their families, but also to their communities, to the United States, and to the countries of the rest of the world as well.

Amidst changing external conditions, the University cannot be sure of what knowledge and what talents will best prepare the citizens of the future for the general welfare. The chances are that the currently most lucrative professions will not remain so as new combinations of knowledge and skill become more useful to the polity which supports us all.

**Trinity College of Arts and Sciences.** In Trinity College, the liberal arts are a means through which students explore the world of ideas from art and music to neurosciences and physics. The undergraduate program, rated one of the finest in the country, helps students learn how to deal successfully with the challenges, intellectual and philosophical, that modern life provides. Trinity College is a community of outstanding students and talented, nationally-ranked faculty. As members of this community, students learn to ask questions, analyze rationally, challenge ideas, and contribute to the continuing development of knowledge.

The Trinity experience offers a traditional liberal arts base of study and currently requires, within broad limits, exposure to great ideas in the three major areas of intellectual activity: the humanities, social sciences, and natural sciences. It offers exposure across a broad spectrum as well, and interdisciplinary and interdepartmental programs stretch horizons even further. Internships and apprenticeships in areas related to students' majors are increasingly available so that practical experience can complement a more formal education. In a world where people are drawn ever closer together, the understanding of cultural difference and diversity becomes increasingly important. Our study abroad programs are varied and plentiful.

The undergraduate college of arts and sciences is unique in that it is set within a distinguished research university. We believe that this combination provides unparalleled opportunities for interaction with faculty, both inside and outside the classroom. The arts and sciences faculty boasts some of the most highly rated scholar-teachers in the country. They challenge students both to master and to reach beyond the basics of fundamental knowledge. At Duke there is a genuine concern for learning, and students are prepared by academic challenges and their individual experiences for the critical decision-making required of them for participatory citizenship, full personal lives, and successful careers.

**School of Engineering.** The undergraduate engineering program at Duke University is designed both for students who intend to become professional engineers and for those who desire a modern, general education based on the problems and the promises of a technological society. The environment in which students are educated is as important in shaping their future as their classroom experiences. In the Duke School of Engineering this environment has two major components: one is modern technology derived from the research and design activities of faculty and students in the school; the other is the liberal arts environment of the total University, with its humanitarian, social, and scientific emphases.

Engineering is not a homogeneous discipline; it requires many special talents. Some faculty members in the School of Engineering are designers; they are problem-oriented, concerned with teaching students how to solve problems—how to synthesize relevant information and ideas and apply them in a creative, feasible design. Other engineering faculty members function more typically as scientists; they are method-oriented, using the techniques of their discipline in their teaching and research to investigate various natural and artificial phenomena.

*Degree Programs*





## Degrees and Academic Credit

Duke University offers in Trinity College of Arts and Sciences the degrees of Bachelor of Arts and Bachelor of Science, and in the School of Engineering the degree of Bachelor of Science in Engineering. Within the curriculum of each college or school, students have the major responsibility for designing and maintaining a course program appropriate to their background and goals. They are assisted by faculty advisors, departmental Directors of Undergraduate Studies, and academic deans.

Credit toward a degree is earned in units called semester courses (s.c.), commonly abbreviated as courses. These courses ordinarily consist of three to four hours of instruction each week of the fall or spring semester or the equivalent total number of hours in a summer term. Double courses, half courses, and quarter courses are also recognized.

## Trinity College of Arts and Sciences

**Effective for students who matriculate as degree candidates after May 1, 1988:**

A variety of approaches to a liberal education is provided by Program I and II. Either program leads to the Bachelor of Arts or Bachelor of Science degree, and each requires thirty-four semester courses.

### PROGRAM I

Program I provides for the experience and achievement that constitute a liberal education. The ability to organize ideas and to communicate them with clarity and precision is refined by completing the writing course and by the requirement for discussion in small groups. Knowledge of a foreign language contributes to an understanding of the nature of language itself and to perspectives on other cultures. Through courses in arts and literatures students learn about the creative products of the human intellect; courses about civilizations ask students to attend to the analysis and evaluation of ideas and events that shape civilizations past and present. Through courses in natural sciences students learn how to interpret and utilize information in an increasingly technological world, while courses in quantitative reasoning help develop skills of inference and analysis. Finally, through courses in the social sciences students learn about the causes of human behavior and about the origins and functions of the social structures in which we operate.

Students must complete the requirements listed below and explained, where necessary, on the following pages. No degree requirements, except the requirement for thirty-four course credits and continuation requirements, may be met by a course passed under a pass/fail option unless the course is offered only on that basis.

**Writing.** Students are required to demonstrate ability to write effective English prose by completing a course in expository writing, ordinarily University Writing Course 4, 5, 6, 7, or 8. See the section University Writing Program in the chapter "Courses of Instruction."

**General Studies** consisting of courses in five of the following six areas of knowledge:

- Arts and Literatures (AL)
- Civilizations (CZ)
- Foreign Languages (FL)
- Natural Sciences (NS)
- Quantitative Reasoning (QR)
- Social Sciences (SS).

- In four of these areas a student must take three courses. Two of these three courses in each area must be related (see below), and at least one of the three in each area must be at the 100-level.
- In the remaining area a student must take two courses.
- Advanced placement credits will *not* substitute for courses in these areas.
- Courses counting toward requirements in a major (and additional courses taken in the major department) do *not* count toward more than *two* of these areas.

**The Major** consists of the requirements for majors in the department or program in which a student wishes to obtain a bachelor's degree (see below). These requirements are described under the course listing for each department or program. Advanced placement courses may substitute for courses in the major as described by each department.

**Elective courses.** Advanced placement credits may function as elective courses. Courses that a student is using as electives may or may not carry an area of knowledge designation.

**Small Group Learning Experiences.**

- Before reaching junior status: at least one full course designated as a seminar, tutorial, or independent study; or a combination of two preceptorials or discussion sections.
- During the junior and senior years: at least two full courses designated as seminars, tutorials, independent study, or a thesis.

**Course credits.** There are several separate and specific requirements concerning course credits in Trinity College. Thirty-four (34) courses are required for graduation, not more than two with a grade of *D*, and including:

- At least* seventeen (17) at Duke (including the senior year).
- At least* twenty-one (21) outside the major department.
- For the major (including courses that the major department or program requires outside itself): *no more* than seventeen (17) total for a Bachelor of Arts major and *no more* than nineteen (19) for a Bachelor of Science major.
- At least* twelve (12) courses at or above the 100-level.
- No more* than: one credit of physical education activity and dance activity (i.e., two half-credit activity courses), two credits for house courses (i.e., four half-credit house courses), six from a professional school (e.g., business, engineering, medicine), and four in military science.

**Quality of Work.** Passing grades are expected in all course work, but see pages below for minimum continuation requirements. Students accept personal responsibility for understanding and meeting the requirements of the curriculum.



**General Studies (Distribution of Courses).** Students achieve breadth and balance of intellectual experience by taking courses in at least five of the six areas of knowledge. Courses that can be taken to satisfy the distribution requirement are identified in the *Bulletin* by a two-letter code (AL, CZ, FL, NS, QR, SS). In four of the areas of knowledge a student must take at least three courses. At least one of the three courses must be at the 100 or 200 level and at least two of the three courses must be related (see below). In one additional area of knowledge a student is required to take at least two courses. Courses counting toward requirements in a major (and additional courses taken in the major department) do *not* count toward *more than two* of these areas.

**Related Courses.** Students achieve a measure of depth in their general course of study by taking at least *two related courses* that support or complement each other in *each of four areas of knowledge*. The related course work provision stimulates students to make considered choices about their course distribution. It encourages the choice of courses that develop a special interest in depth, of courses that extend and enhance what a student has already learned, or of courses that build on each other to develop an area in greater depth than can be explored in a single semester. Related courses may be, for example, a defined two-course sequence (such as Mathematics 31, 32), a course and its prerequisite, or two courses that are used to develop topical, geographic, or temporal connections. Choices of related courses are made in consultation with a faculty advisor.

**The Major.** Students are expected to acquire some mastery of a particular discipline or interdisciplinary area as well as to achieve a breadth of intellectual experience. They therefore complete a departmental major, an interdisciplinary major, or an interdepartmental concentration. At least half the courses for a student's major field must be taken at Duke although departments may make exceptions to this rule in special circumstances. A student who completes requirements for two majors may have both recorded on the official record. See the chapter "Academic Procedures and Information" for the majors within each degree and for procedures on declaring a major.

**Departmental Major.** The courses for a departmental major may include introductory or basic prerequisite courses and higher-level courses in the major department or in the major department and related departments. The courses required in the major department must include at least five beyond the introductory or basic prerequisite level, but these required courses may not exceed eight semester course credits for the Bachelor of Arts degree or ten for the Bachelor of Science degree. Furthermore, the total number of courses required at any level in the major and related departments may not exceed seventeen semester courses for the Bachelor of Arts degree and nineteen semester courses for the Bachelor of Science degree. Students may elect to take more courses in their major than are required, but only thirteen courses in one (the major) department count toward the graduation requirement of thirty-four semester courses. Departmental majors are available in anthropology, art design, art history, chemistry, classical studies, economics, English, French, geology, Germanic languages and literature, Greek, history, Latin, mathematics, music, philosophy, physics, political science, psychology, public policy studies, religion, Slavic languages and literatures, sociology, and Spanish. The courses required for a major are specified by the department. The requirements appear in the section following each department's course descriptions.

**Program Major.** Students may satisfy the requirement by completing work prescribed for a major in approved programs, often interdisciplinary. These programs include Afro-American studies, biology, Canadian studies, comparative area studies, drama, and medieval and Renaissance studies. The requirements for these majors appear under each program in the chapter "Courses of Instruction."

**Interdepartmental Concentration.** A student may pursue an interdepartmental major program designed by the student and advisors as an alternate means of satisfying the major requirement. An interdepartmental concentration consists of at least three courses

beyond the introductory level in each of two or more departments. For procedures see the section on declaration of major or division in the chapter "Academic Procedures and Information."

**Small Group Learning Experiences.** By supplementing the classroom and lecture methods of instruction, small group learning experience courses assure students opportunities to engage in discussion, develop skills, refine judgment, and defend ideas when challenged. A *seminar* (ordinarily indicated by the suffix *S*) is an independent course of twelve to fifteen (exceptionally to twenty) students who, together with an instructor, engage in disciplined discussion. The number of meeting hours per term is the same as for regular courses of equivalent credit. Instructors are encouraged to present to each student at the end of the term a written evaluation of the student's work. A *discussion section* (*D*) is a group of approximately ten students and an instructor, in which discussion is the paramount characteristic; it is an integral part of a larger regular course, and every member of the class is enrolled. A *preceptorial* (*P*) is a group of usually no more than twelve students and an instructor in which discussion is the primary component; it is an additional and optional unit attached to a regular course involving one or more extra meetings per week. No additional course credit is given for a preceptorial. A *tutorial* (*T*) is a group of one to five students and an instructor meeting for discussion which is independent of any other course. For *independent study* students pursue their own interests in reading, research, or writing, but meet with an instructor for guidance and discussion. See the section on independent study in the chapter "Academic Procedures and Information." Instructors in all courses that satisfy the requirements for small group learning experiences, including independent study, must meet with the students at least once every two weeks. The requirements for small group learning experiences are listed under Program I, above.

**Course Requirements.** Thirty-four semester courses are required for graduation, including a maximum of two courses passed with a grade of *D*. At least seventeen courses, including the work of the senior year, must be passed at Duke. Twelve courses must be at the advanced (100-200) level. The thirty-four course credits may include (1) no more than thirteen courses in one department; (2) no more than seventeen total for a major (including those required in related departments) under the Bachelor of Arts degree and no more than nineteen total for a major (including those required in related departments) under the Bachelor of Science degree; (3) no more than one semester-course credit in physical education activity and dance activity (i.e., a total of two half-credit activity courses); (4) no more than two credits for house courses; (5) no more than six credits for courses taken in professional schools; and (6) no more than four semester-course credits in military science. Certain military science courses listed as carrying credit do not count toward graduation but appear on a student's permanent academic record. Military science courses, like professional school and all physical education courses, do not satisfy general studies (area of knowledge) requirements. American Dance Festival courses are included in the total limitation on physical education/dance activity courses noted above in this paragraph.

**Residence.** A residence period of eight semesters is the typical amount of time a student may take to earn either the Bachelor of Arts or the Bachelor of Science degree. This period may be extended for one or two semesters by a student's academic dean for legitimate reasons, if it seems probable that an extension will enable the student to complete all remaining requirements for graduation. A student will not be permitted residence of more than ten semesters in order to be graduated.

For the minimum residence period, at least seventeen courses must be satisfactorily completed at Duke, including the courses needed to meet the senior year residence requirement. (For the purposes of the residence requirement, advanced placement credits are *not* considered as courses taken at Duke.) If only seventeen courses are taken at Duke, they must include the student's last eight courses. A student with more than seventeen

courses at Duke may take two of the last eight courses at another approved institution. A student who has completed twenty-six courses at Duke may take four of the last eight courses at another approved institution. Courses taken elsewhere must be approved in advance by the appropriate Director of Undergraduate Studies and the student's academic dean.

Former students of Trinity College or the Woman's College who have been out of college for at least six years, and left in good standing, may, with certain provisos, take up to eight semester-courses in another institution of approved standing in final fulfillment of graduation requirements. Further information can be obtained from the Associate Dean of Trinity College of Arts and Sciences responsible for coordinating readmission.

**Quality of Work (Continuation Requirements).** A student must achieve a satisfactory record of academic performance each term and make satisfactory progress toward graduation each year to continue enrollment in college. A student who fails to meet the minimum requirements described below must leave college for at least two semesters; a summer session may be counted as a semester. The student may apply to Trinity College of Arts and Sciences for readmission. If, after readmission, the student again fails to meet continuation requirements, the student will be ineligible, except in extraordinary instances, for readmission to Trinity College.

*Satisfactory Performance Each Term.* A student who does not receive a passing grade in all courses must meet the following minimum requirements or be withdrawn from the college.

*In the Fall or Spring Semester:* (1) in the first semester of enrollment at Duke, a student with a normal course load (of at least four semester courses, as defined in the chapter "Academic Procedures and Information") may not fail more than two full courses; (2) after the first semester at Duke, a student with four or more courses may not fail more than one full course; (3) a first-semester student, whether a freshman or a transfer student, who for a special reason has received permission from an academic dean to enroll in fewer than four courses may not fail more than one full course; (4) a student taking an authorized underload after the first semester at Duke must earn all passing grades. (Students may not carry an underload without the permission of their academic dean.) For the purposes of continuation, incomplete work in any course is considered a failure to achieve satisfactory performance in that course. Therefore, where continuation is in question, incomplete work in any course must be completed with a passing grade in time for final grades to be submitted to the Office of the Registrar no later than the weekday preceding the first day of classes of the spring semester, or prior to the first day of classes of the second term of the summer session, as appropriate. In the case of incomplete work in the spring semester, this requirement applies whether or not the student plans to attend one or more terms of the summer session. The student, however, may not enroll in a summer term at Duke unless the requirement of satisfactory performance each semester has been satisfied.

*In the Summer Session:* to maintain enrollment at Duke a student may not fail more than one full course in a summer term or a summer session. For purposes of continuation, incomplete work is considered failure to achieve a satisfactory performance in that course. Therefore, when eligibility to continue from the summer session to the fall is in question, incomplete courses must be satisfactorily completed in time for a passing grade to be submitted to the Office of the Registrar no later than the weekday preceding the first day of fall classes. Moreover, no student may enter the fall semester with more than one incomplete grade from the preceding spring and summer.

Any student excluded from the college under the provisions of these regulations may on request have the case reviewed by the Senior Associate Dean of Trinity College of Arts and Sciences.

*Satisfactory Progress toward Graduation.* Each year prior to the beginning of fall term classes, a student must have made satisfactory progress toward fulfillment of curricular



requirements to be eligible to continue in the college; i.e., a certain number of courses must have been passed *at Duke* according to the following schedule:

Fall Matriculants		Spring Matriculants	
<u>To be eligible to continue to the</u>	<u>A student must have passed at Duke</u>	<u>To be eligible to continue to the</u>	<u>A student must have passed at Duke</u>
3rd semester	6 semester courses	2nd semester	2 semester courses
5th semester	14 semester courses	4th semester	10 semester courses
7th semester	24 semester courses	6th semester	19 semester courses
		8th semester	28 semester courses

For students who have interrupted their university studies, the continuation requirement must still be satisfied before the beginning of each fall term. For such students, the number of courses needed to satisfy the continuation requirement is determined from the table above, based on which semester they will enter in the fall term.

Courses taken in the summer term at Duke may be used to meet this requirement; advanced placement may *not* be used to satisfy it. No more than two courses completed with *D* grades may be counted toward fulfilling this annual continuation requirement.

## PROGRAM II

**Nature and Purpose.** Program II is an alternate approach leading to either the Bachelor of Arts or the Bachelor of Science degree which offers the student who has an unusual interest or talent in a single field, or an unusual combination of interests or talents in several fields, an opportunity to plan and carry out a special curriculum adapted to these interests and needs. The student, with the assistance of a departmental Program II advisor, designs an individual plan of study for the whole or the remainder of the student's college career. Together, they assess the student's background, needs, and ambitions and evaluate the resources at the University or outside it as means of satisfying those ambitions. They consider what academic courses would be useful and also take into account that a term of independent study or work/study on or off campus, or a period of study abroad, might be appropriate. Each curriculum is tailored to the special interests and talents of the student for whom it is designed. Among the many topics for Program II have been American studies, primatology, dramatic literacy, linguistics, biochemistry, mariculture, behavioral science, environmental policy, modern thought, and mass communications.

**Admission.** Students interested in Program II should confer with the Directors of Undergraduate Studies in the departments closest to their interests, with the dean responsible for Program II, and with the Chairman of the Committee on Program II, whose name may be obtained from 04 Allen Building. If the student seems eligible for Program II, the Director or other departmental advisor, or an interdepartmental committee, will counsel the student concerning the design of the curriculum. When an interdepartmental committee is needed, one department will bear administrative responsibility. The curriculum must be approved by the department and also by the Committee on Program II of the Undergraduate Faculty Council of Arts and Sciences. Upon endorsement by that committee, the program becomes an obligation assumed by the student although it may be modified later with the approval of the department and the Committee on Program II. A description of the plan is sent to the academic dean responsible for Program II, and each semester the student's progress in achieving the plan is reviewed.

Until formally accepted into Program II, a student should register for courses to satisfy the curricular requirements of Program I. Upon acceptance into Program II, a student is relieved of most, but not all, requirements expected of Program I students. Should Program II be dropped for any reason, the student assumes all requirements of Program I. Ordinarily, students will be accepted into Program II only after their first semester at Duke; they are ineligible to apply for admission to Program II after their junior year. Further





information about Program II may be obtained from the office of the academic dean responsible for Program II, in 04 Allen Building.

**General Requirements.** Apart from the requirements arising from the approved plan of work, a Program II student must satisfy certain general requirements: thirty-four semester-course credits for graduation; the regulations on military science courses; and residence, although the requirements relating to the last eight courses may be adjusted to suit the student's approved plan of work. Graduation with distinction is available for qualified students in Program II. See the section on honors in the chapter "Academic Procedures and Information."

### **Effective for students who matriculated before May 1, 1988:**

A variety of approaches to a liberal arts education is provided by Program I and Program II. Either program leads to the Bachelor of Arts or Bachelor of Science degree and requires thirty-two semester courses. Students study in the following divisions of learning:

*Humanities.\** Art and Art History, Asian and African languages (Arabic, Chinese, Hebrew, Hindi-Urdu, Japanese, Korean, Persian, and Swahili), classical studies (including Greek and Latin), dance, drama, English, Germanic languages and literature, Institute of the Arts, Judaic studies, literature, music, philosophy, religion, Romance languages (including French, Italian, Portuguese, and Spanish), and Slavic languages and literatures (including Russian and Polish).

*Natural Sciences and Mathematics.* Biology, chemistry, computer science, genetics, geology, marine sciences, mathematics, physics, and statistics.

*Social Sciences.\** Biological anthropology and anatomy, cultural anthropology, economics, education, history, political science, psychology, public policy studies, and sociology.

### **PROGRAM I**

Program I provides for the experience and achievement that constitute a liberal education. The ability to organize ideas and to communicate them with clarity and precision is refined by completing the writing requirement and the requirements for discussion in small groups. Knowledge of a foreign language contributes to an understanding of the nature of language itself and to perspectives on other cultures. The distribution requirements ensure learning about the concepts and analytical methods in the humanities and the arts, the social sciences, and the natural sciences. Additionally, through a course in the history of civilization students acquire knowledge of the complexity of forces that influence cultures and societies; through a course in literature they learn of the conscious products of the human intellect; and through study in an empirical natural science they gain an understanding of nature and the methods whereby humanity has reached that understanding. Students must complete the requirements listed below and explained, where necessary, on the following pages. No degree requirements, except the requirement for thirty-two course credits and the continuation requirements, may be met by a course passed under the pass/fail option unless the course is offered only on that basis.

#### **Writing**

One course in writing (page 27).

#### **Foreign Language**

Eligibility to enter the third semester of college language instruction by completing two semester courses in one language at Duke, or the equivalent (page 27).

#### **Distribution of Courses**

Students complete the requirements for a major (see section "The Major" below) and in addition take approved courses in each of the following:

- In the history of civilization field: one course, if not included in the major (see lists following for approved courses);
- In the literature field: one course, if not included in the major (see lists following for approved courses);
- In the empirical natural science field: one course, if not included in the major (see lists following for approved courses);

#### **and in addition:**

- In one division † outside that of the major: four semester courses, including two at the advanced level (for excluded courses see list following, entitled "Courses that Do Not Satisfy the Divisional Requirements");
- In the other division † outside that of the major: two semester courses (for excluded courses see list following, entitled "Courses that Do Not Satisfy the Divisional Requirements").

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\*Afro-American studies; Canadian studies; comparative area studies; distinguished professor courses; film; human development; interdisciplinary courses; linguistics; medieval and Renaissance studies; perspectives in Marxism and society; science, technology, and human values; and women's studies include courses in more than one division. Nondivisional courses in the military sciences and in health, physical education, and recreation are also offered. In addition, advanced students in Trinity College may select a limited number of courses from among certain courses offered by the professional schools at Duke University.

†For the subjects in each division of learning, see above.

## For students who matriculated before May 1, 1988

### Small Group Learning Experiences

Courses taught for small groups (described more fully below), as follows:

- Before reaching junior status: at least *one* full semester course designated as a *seminar, tutorial, or independent study*; or a combination of two *preceptorials* or *discussion sections*.
- During the junior and senior years: at least *two* semester-course credits for *seminars, tutorials, independent study, or a thesis*.

### Course Credits

Thirty-two semester-course credits (no more than two with a grade of *D*), including:

- At least sixteen at Duke (ordinarily including the senior year).
- At least nineteen outside the major department.
- No more than seventeen total for a Bachelor of Arts major and no more than nineteen total for a Bachelor of Science major.
- At least twelve at the advanced level.
- No more than: one credit of physical education activity and dance activity (i.e., two half-credit activity courses), two credits for house courses (i.e., four half-credit house courses), six from a professional school (e.g., business, engineering, medicine), and four in military science.

### Quality of Work

All passing grades are expected, but see section “Quality of Work” for minimum continuation requirements.

**Writing.** Students are required to demonstrate ability to write effective English prose by completing a course in expository writing, ordinarily University Writing Course 4, 5, 6, 7 or 8. See the section University Writing Program in the chapter “Courses of Instruction.”

**Foreign Language.** This requirement to assure that students have some knowledge of a foreign culture may be met in any of the following ways: (1) by passing one of the following courses: Arabic 2; Chinese 2, 2A; French 2, 12, 181; German 2, 14, 181; Greek 2, 10, 12, 181S; Hebrew 2; Hindi-Urdu 2; Italian 2, 181; Japanese 2; Korean 2; Latin 2, 181S; Persian 2; Polish 12; Portuguese 181; Religion 116 (Hebrew); Russian 2, 14; Spanish 2, 12, 14, 181; Swahili 2, 14; Yiddish 181; (2) by presenting a College Board Advanced Placement Score of 4 or 5, or score of 3 validated by satisfactory completion of an advanced course; or (3) by achieving a score on a College Board Achievement Test or College Board Placement Test sufficient to permit enrollment at the intermediate level of foreign language instruction (see the chapter “Academic Procedures and Information”).

Students whose native language is not English may meet the requirement by successful completion of a course in English composition. Transfer students may satisfy the requirement in any of the above ways or by having fulfilled the foreign language graduation requirement at another college or university prior to entering Duke. Students who have knowledge of a foreign language other than those for which College Board tests are available may request to be examined in that language by special arrangement after matriculation.

**Distribution of Courses.** Students achieve breadth and balance of intellectual experience by taking courses in each of the three divisions of learning (the humanities, natural sciences, and social sciences, see below) and by taking in addition an approved course in each of three selected fields (history of civilization, literature, and empirical natural sciences). Courses that satisfy these requirements consist of the essential subject matter and substance of the discipline. Courses that satisfy the requirements for small group learning experiences may be used also to satisfy these requirements. Courses taken on the pass/fail basis, however, do not satisfy these requirements unless offered only on the pass/fail basis.

**Divisions of Learning.** Students must complete a certain number of *nonskills* courses in each of the three divisions (see table below):

**First Division.** The division of the major is called the first division. Each student must complete requirements for a major in a single discipline or in an interdisciplinary program. Thereby the requirement for the first division will automatically be satisfied. See the sections on the major below, in the chapter “Academic Procedures and Information,” and also the section on the major following each department’s course descriptions.

**Second Division.** Each student must pass at least four semester courses in a second division of the student’s choice. At least two of the four courses must be at the 100 or 200 level.

**Third Division.** Each student must pass at least two semester courses in the remaining division.

**COURSES THAT DO NOT SATISFY THE DIVISIONAL DISTRIBUTION REQUIREMENTS—Military and Naval Science Courses, Aerospace Studies Courses, American Dance Festival Courses, Courses in the Professional Schools, Physical Education Courses, and also the Following Skills Courses:**

Arabic	1, 2, 63, 64
Art	53, 54, 56
Arts Institute	20S, 102, 130, 150
Biology	45S, 196D
Chinese	1, 1A, 2, 2A, 3, 63, 64

## For students who matriculated before May 1, 1988

Dance	134 and activity courses
Drama	71, 81, 82, 83S, 84, 101, 161, 167, 177
English	3, 12, 28S, 61S, 62S, 71, 72, 73S, 117S
French	1-2, 12, 63, 76, 181
German	1-2, 11, 14, 63, 76, 105, 181, 182
Greek	1-2, 11-12, 181
Hebrew	1, 2, 63, 64
Hindi-Urdu	1, 2, 63, 64
Italian	1-2, 63, 76, 181
Japanese	1, 2, 63, 64
Korean	1, 2, 63, 64
Latin	1-2, 181S
Mathematics	9-10, 19
Music	applied music (except for tutorials), 161, 162, 163, 164
Persian	1, 2, 63, 64
Polish	11, 12
Political Science	138, 236
Portuguese	181
Psychology	117
Religion	115-116
Russian	1, 2, 3, 14, 63, 64, 65
Sociology	132, 133
Spanish	1-2, 12, 14, 63, 76, 181
Swahili	1, 2, 14, 63, 64
University Writing	4, 5, 6, 7, 8, 117S
Yiddish	181

*Fields of Knowledge.* In addition to fulfilling the divisional requirements, students must pass one course from each of the following three lists:

### COURSES THAT SATISFY THE REQUIREMENTS IN HISTORY OF CIVILIZATION, LITERATURE, AND EMPIRICAL NATURAL SCIENCE

#### I. History of Civilization

Afro-American Studies	56, 145, 146
Art	69, 70, 114, 123, 124, 126, 131, 132, 133, 134, 140, 141, 142, 143, 145, 147, 148, 149, 151, 152, 153, 161, 165, 186, 189
Classical Studies	11S, 12S, 53, 54, 93, 101, 102, 103, 104, 123, 124, 131, 135, 145, 155
Cultural Anthropology	101, 102, 120, 121, 122, 123, 124S, 126, 127, 128, 130, 131, 133, 134, 147, 148, 168
Drama	51, 151
Economics	132, 150, 184
French	136S, 139
German	129, 130
History	21, 21S, 22, 22S, 23, 25, 26, 49S, 53, 54, 75, 76, 91, 91S, 92, 92S, 93S, 100, 101G, 101K, 102G, 103, 104, 107, 108, 110, 111, 112, 113, 115, 117, 120, 121, 121A, 121B, 122, 123S, 124S, 125, 126, 128, 129, 130, 131, 132, 133, 134, 135, 136, 138, 139, 141, 142, 143, 144, 145, 146, 149, 150, 151, 152, 156, 157, 158, 160, 161, 162, 168S, 171, 173, 174, 180, 181, 182, 183S, 184, 193, 194, 199
Interdisciplinary Courses	101, 102, 103, 162, 163, 184
Music	119, 138
Philosophy	93, 94, 108, 117, 119, 120, 132, 138, 139
Political Science	115, 131, 135, 136, 151, 161S, 163, 184, 187
Religion	51, 56, 57, 109, 124, 125, 133, 160, 161, 162, 163
Sociology	111, 138, 170, 184

#### II. Literature

Afro-American Studies	173, 174
Arabic	171S
Chinese	135, 136, 141S, 142S, 171
Classical Studies	63, 64
Distinguished Professor Courses	201, 203, 205
Drama	55, 64, 115, 116, 118, 119, 120, 121, 122, 123, 124S, 126, 137, 147S, 148, 149, 151, 220S



## For students who matriculated before May 1, 1988

English	20, 21S, 22S, 23S, 24S, 25S, 26S, 49S, 51, 52, 91, 92, 93, 93S, 121, 122, 123, 124, 125, 126, 127, 128, 131, 133, 134, 135, 136, 137, 138, 139S, 141, 143, 144, 145, 151, 152, 153, 154, 155, 161, 162, 163, 164, 165, 167, 168, 169S, 171S, 173, 174, 175, 179S, 180, 181, 182, 186, 187, 221, 225, 235, 241, 245, 251, 263, 267, 269, 275
French	101, 102, 103S, 104S, 141S, 142S, 145S, 146S, 147, 148, 151, 152, 153, 155, 156, 158, 162, 163, 166, 167, 170, 248, 251, 252, 255, 256, 257, 258, 261, 263, 265, 266, 290S
German	101, 103S, 104S, 109S, 115S, 120S, 125S, 126S, 127S, 131S, 132, 172, 173, 175, 201S, 202S, 205, 206, 207S, 209S, 211S, 214S, 215S, 217S, 230S
Greek	63, 64, 103S, 104S, 203, 205, 222
Interdisciplinary Courses	106, 155
Italian	101, 102, 283, 284, 285
Japanese	155, 156, 161
Latin	63, 64, 103S, 104S, 105S, 112S, 117T, 204, 221
Literature	50, 51, 100, 101, 121, 122, 125, 128, 129, 132, 145, 155, 159, 179, 180, 199S
Persian	101
Philosophy	108
Polish	174
Political Science	174S
Portuguese	182
Religion	50, 52, 55, 106, 108, 128, 147, 172, 188, 233, 287
Russian	124, 161, 162, 175, 176, 180, 181, 183
Spanish	101, 102, 103S, 104S, 105, 106, 107S, 108S, 121, 141S, 142S, 146, 151, 153, 163, 165S, 166, 171, 245, 246, 253, 254, 258S, 275, 276, 277
Yiddish	171

### III. Empirical Natural Science

Unless classified as a skills course, any course offered by the natural science departments (botany, chemistry, geology, physics, zoology) which carries one semester-course credit or more satisfies this requirement.

**The Major.** Students are expected to acquire some mastery of a particular discipline or interdisciplinary area as well as to achieve a breadth of intellectual experience. They therefore complete a departmental major, an interdisciplinary major, or an interdepartmental concentration. At least half the courses for a student's major field must be taken at Duke although departments may make exceptions to this rule in special circumstances. A student who completes requirements for two majors may have both recorded on the official record. See the chapter "Academic Procedures and Information" for the majors within each degree and for procedures on declaring a major.

**Departmental Major.** The courses for a departmental major may include introductory or basic prerequisite courses and higher-level courses in the major department or in the major department and related departments. The courses required in the major department must include at least five beyond the introductory or basic prerequisite level, but these required courses may not exceed eight semester course credits for the Bachelor of Arts degree or ten for the Bachelor of Science degree. Furthermore, the total number of courses required at any level in the major and related departments may not exceed seventeen semester courses for the Bachelor of Arts degree and nineteen semester courses for the Bachelor of Science degree. Students may elect to take more courses in their major than are required, but only thirteen courses in one (the major) department count toward the graduation requirement of thirty-two semester courses. Departmental majors are available in anthropology, art design, art history, chemistry, classical studies, economics, English, French, geology, Germanic languages and literature, Greek, history, Latin, mathematics, music, philosophy, physics, political science, psychology, public policy studies, religion, Slavic languages and literatures, sociology, and Spanish. The courses required for a major are specified by the department. The requirements appear in the section following each department's course descriptions.

**Program Major.** Students may satisfy the requirement by completing work prescribed for a major in approved programs, often interdisciplinary. These programs include Afro-American studies, biology, Canadian studies, comparative area studies, drama, and medieval and Renaissance studies. The requirements for these majors appear under each program in the chapter "Courses of Instruction."

**Interdepartmental Concentration.** A student may pursue an interdepartmental major program designed by the student and advisors as an alternate means of satisfying the major requirement. An interdepartmental concentration consists of at least three courses beyond the introductory level in each of two or more departments. For procedures see the section on declaration of major or division in the chapter "Academic Procedures and Information."

**Small Group Learning Experiences.** By supplementing the classroom and lecture methods of instruction, small group learning experience courses assure students opportunities to engage in discussion, develop skills, refine judgment, and defend ideas when challenged. A *seminar* (ordinarily indicated by the suffix S) is an independent course of twelve to fifteen (exceptionally to twenty) students who, together with an instructor, engage in disciplined discussion. The number of meeting hours per term is the same as for regular courses of equiva-

## For students who matriculated before May 1, 1988

lent credit. Instructors are encouraged to present to each student at the end of the term a written evaluation of the student's work. A *discussion section (D)* is a group of approximately ten students and an instructor, in which discussion is the paramount characteristic; it is an integral part of a larger regular course, and every member of the class is enrolled. A *preceptorial (P)* is a group of usually no more than twelve students and an instructor in which discussion is the primary component; it is an additional and optional unit attached to a regular course involving one or more extra meetings per week. No additional course credit is given for a preceptorial. A *tutorial (T)* is a group of one to five students and an instructor meeting for discussion which is independent of any other course. For *independent study* students pursue their own interests in reading, research, or writing, but meet with an instructor for guidance and discussion. See the section on independent study in the chapter "Academic Procedures and Information." Instructors in all courses that satisfy the requirements for small group learning experiences, including independent study, must meet with the students at least once every two weeks. The requirements for small group learning experiences are listed under Program I, above.

**Course Requirements.** Thirty-two semester courses are required for graduation, including a maximum of two courses passed with a grade of *D*. At least sixteen courses, including the work of the senior year, must be passed at Duke. Twelve courses must be at the advanced (100-200) level. The thirty-two course credits may include (1) no more than thirteen courses in one department; (2) no more than seventeen total for a major (including those required in related departments) under the Bachelor of Arts degree and no more than nineteen total for a major (including those required in related departments) under the Bachelor of Science degree; (3) no more than one semester-course credit in physical education activity and dance activity (i.e., a total of two half-credit activity courses); (4) no more than two credits for house courses; (5) no more than six credits for courses taken in professional schools; and (6) no more than four semester-course credits in military science. Certain military science courses listed as carrying credit do not count toward graduation but appear on a student's permanent academic record. Military science courses, like professional school and all physical education courses, do not satisfy distribution or fields of knowledge requirements. American Dance Festival courses are included in the total limitation on physical education/dance activity courses noted above in this paragraph.

**Residence.** A residence period of eight semesters is the typical amount of time a student may take to earn either the Bachelor of Arts or the Bachelor of Science degree. This period may be extended for one or two semesters by a student's academic dean for legitimate reasons, if it seems probable that an extension will enable the student to complete all remaining requirements for graduation. A student will not be permitted residence of more than ten semesters in order to be graduated.





## For students who matriculated before May 1, 1988

For the minimum residence period, at least sixteen courses must be satisfactorily completed at Duke, including the courses needed to meet the senior year residence requirement. (For the purposes of the residence requirement, advanced placement credits are *not* considered as courses taken at Duke.) If only sixteen courses are taken at Duke, they must include the student's last eight courses. A student with more than sixteen courses at Duke may take two of the last eight courses at another approved institution. A student who has completed twenty-four courses at Duke may take four of the last eight courses at another approved institution. Courses taken elsewhere must be approved in advance by the appropriate Director of Undergraduate Studies and the student's academic dean.

Former students of Trinity College or the Woman's College who have been out of college for at least six years, and left in good standing, may, with certain provisos, take up to eight semester courses in another institution of approved standing in final fulfillment of graduation requirements. Further information can be obtained from the Associate Dean of Trinity College of Arts and Sciences responsible for coordinating readmission.

**Quality of Work (Continuation Requirements).** A student must achieve a satisfactory record of academic performance each term and make satisfactory progress toward graduation each year to continue enrollment in college. A student who fails to meet the minimum requirements described below must leave college for at least two semesters; a summer session may be counted as a semester. The student may apply to Trinity College of Arts and Sciences for readmission. If, after readmission, the student again fails to meet continuation requirements, the student will be ineligible, except in extraordinary instances, for readmission to Trinity College.

**Satisfactory Performance Each Term.** A student who does not receive a passing grade in all courses must meet the following minimum requirements or be withdrawn from the college.

**In the Fall or Spring Semester:** (1) in the first semester of enrollment at Duke, a student with a normal course load (of at least four semester courses, as defined in the chapter "Academic Procedures and Information") may not fail more than two full courses; (2) after the first semester at Duke, a student with four or more courses may not fail more than one full course; (3) a first-semester student, whether a freshman or a transfer student, who for a special reason has received permission from an academic dean to enroll in fewer than four courses may not fail more than one full course; (4) a student taking an authorized underload after the first semester at Duke must earn all passing grades. (Students may not carry an underload without the permission of their academic dean.) For the purposes of continuation, incomplete work in any course is considered a failure to achieve satisfactory performance in that course. Therefore, where continuation is in question, incomplete work in any course must be completed with a passing grade in time for final grades to be submitted to the Office of the Registrar no later than the weekday preceding the first day of classes of the spring semester, or prior to the first day of classes of the second term of the summer session, as appropriate. In the case of incomplete work in the spring semester, this requirement applies whether or not the student plans to attend one or more terms of the summer session. The student, however, may not enroll in a summer term at Duke unless the requirement of satisfactory performance each semester has been satisfied.

**In the Summer Session:** to maintain enrollment at Duke a student may not fail more than one course in a summer term or a summer session. For purposes of continuation, incomplete work is considered failure to achieve a satisfactory performance in that course. Therefore, when eligibility to continue from the summer session to the fall is in question, incomplete courses must be satisfactorily completed in time for a passing grade to be submitted to the Office of the Registrar no later than the weekday preceding the first day of fall classes. Moreover, no student may enter the fall semester with more than one incomplete grade from the preceding spring and summer.

Any student excluded from the college under the provisions of these regulations may on request have the case reviewed by the Senior Associate Dean of Trinity College of Arts and Sciences.

**Satisfactory Progress toward Graduation.** Each year prior to the beginning of fall term classes, a student must have made satisfactory progress toward fulfillment of curricular requirements to be eligible to continue in the college; i.e., a certain number of courses must have been passed at Duke according to the following schedule:

*To be eligible to continue to the:*

3rd semester  
4th semester  
5th semester  
6th semester  
7th semester  
8th semester

*A student must have passed at Duke:*

6 semester courses  
10 semester courses  
14 semester courses  
18 semester courses  
22 semester courses  
26 semester courses

Courses in the arts and sciences taken in the summer terms at Duke may be used to meet this requirement; advanced placement may *not* be used to satisfy it. No more than two courses completed with *D* grades may be counted toward fulfilling this annual continuation requirement.

### PROGRAM II

**Nature and Purpose.** Program II is an alternate approach leading to either the Bachelor of Arts or the Bachelor of Science degree which offers the student who has an unusual interest or talent in a single field, or an unusual combination of interests or talents in several fields, an opportunity to plan and carry out a special curriculum

## For students who matriculated before May 1, 1988

adapted to these interests and needs. The student, with the assistance of a departmental Program II advisor, designs an individual plan of study for the whole or the remainder of the student's college career. Together, they assess the student's background, needs, and ambitions and evaluate the resources at the University or outside it as means of satisfying those ambitions. They consider what academic courses would be useful and also take into account that a term of independent study or work/study on or off campus, or a period of study abroad, might be appropriate. Each curriculum is tailored to the special interests and talents of the student for whom it is designed. Among the many topics for Program II have been American studies, primatology, dramatic literacy, linguistics, biochemistry, mariculture, behavioral science, environmental policy, modern thought, and mass communications.

**Admission.** Students interested in Program II should confer with the Directors of Undergraduate Studies in the departments closest to their interests, with the dean responsible for Program II, and with the Chairman of the Committee on Program II, whose name may be obtained from 04 Allen Building. If the student seems eligible for Program II, the Director or other departmental advisor, or an interdepartmental committee, will counsel the student concerning the design of the curriculum. When an interdepartmental committee is needed, one department will bear administrative responsibility. The curriculum must be approved by the department and also by the Committee on Program II of the Undergraduate Faculty Council of Arts and Sciences. Upon endorsement by that committee, the program becomes an obligation assumed by the student although it may be modified later with the approval of the department and the Committee on Program II. A description of the plan is sent to the academic dean responsible for Program II, and each semester the student's progress in achieving the plan is reviewed.

Until formally accepted into Program II, a student should register for courses to satisfy the curricular requirements of Program I. Upon acceptance into Program II, a student is relieved of most, but not all, requirements expected of Program I students. Should Program II be dropped for any reason, the student assumes all requirements of Program I. Ordinarily, students will be accepted into Program II only after their first semester at Duke; they are ineligible to apply for admission to Program II after their junior year. Further information about Program II may be obtained from the office of the academic dean responsible for Program II, in 04 Allen Building.

**General Requirements.** Apart from the requirements arising from the approved plan of work, a Program II student must satisfy certain general requirements: thirty-two semester-course credits for graduation; the regulations on military science courses; and residence, although the requirements relating to the last eight courses may be adjusted to suit the student's approved plan of work. Graduation with distinction is available for qualified students in Program II. See the section on honors in the chapter "Academic Procedures and Information."

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## COMBINATION PROGRAMS OF TRINITY COLLEGE AND DUKE PROFESSIONAL SCHOOLS

A student interested in attending a Duke professional school (business, forestry and environmental studies, law, and medicine) may, upon meeting certain requirements, combine the senior year in Trinity College of Arts and Sciences with the first year in the professional school. To qualify the student must (1) successfully complete twenty-six semester courses in Trinity College (twenty-four for students who matriculated prior to May 1, 1988); (2) fulfill all other degree requirements in Trinity College except for eight elective courses; (3) obtain the approval of the appropriate preprofessional advisor and academic dean in Trinity College; and (4) be admitted to the professional school. If the student's application to the professional school is accepted, the student transfers to the professional school for the fourth year and begins work on the professional degree. Upon successful completion of the work in the first year of the professional school, the baccalaureate degree is awarded to the student. The undergraduate record notes the student's enrollment in the combination program, the name of the professional school, the date of graduation from Trinity College, and the degree awarded, but it does not include courses taken in the professional school. Counseling and additional information are available from the preprofessional advisors.

## PREPARATION FOR GRADUATE AND PROFESSIONAL SCHOOLS

Students planning to enter a graduate or professional school should consult their faculty advisors, Director of Undergraduate Studies, or academic dean at the earliest opportunity. Since many graduate and professional schools require special tests for students seeking admission, information regarding requirements should also be obtained from

the catalogs of the appropriate schools. The Office of Counseling and Psychological Services will provide applications for the testing programs.

**Graduate Schools of Arts and Sciences.** As soon as practicable, students should ascertain the requirements of the graduate schools which they are considering and should consult an advisor in the field of the proposed advanced study. Most graduate schools have requirements in foreign languages, and candidates for the degree of Doctor of Philosophy may be required to pass reading examinations, usually in German and French.

**Graduate Schools of Engineering.** Students interested in graduate work in engineering should consult the Dean of the School of Engineering or the Director of Graduate Studies in one of the engineering departments. Most engineering graduate schools require that a candidate have the equivalent of a Bachelor of Science in Engineering degree; however, students in the natural and social sciences may obtain conditional admission if they have a sufficient background in mathematics.

**Graduate Schools of Business Administration.** Students seeking information about graduate schools of business should consult the advisor in Trinity College. In preparing for graduate business school, students should gain a good liberal arts background, choosing courses that will help them develop communication skills, analytical skills, and an understanding of human nature. Students have often chosen such courses as Computer Science 51, Economics 1 and 2 (or 51 and 52), Management Sciences 53, and Mathematics 31 as those which develop analytical skills. For further information concerning undergraduate preparation, see the *Prebusiness Handbook for Duke Students* or *The Official Guide to MBA Programs*, published by the Graduate Management Admission Council; these publications and other resource materials are available in the Prebusiness Advising Office.

**Medical and Dental Schools.** Students planning to enter schools of medicine and dentistry can prepare for admission by completing any of the regular departmental majors in Program I or by completing Program II, and by taking those courses required by the professional schools of their choice. Virtually all medical schools and most schools of





dentistry require the same basic group of college premedical courses—a year of biology, a year each of inorganic and organic chemistry, and a year of general physics. In addition, many schools require a year of English and courses in the humanities or social sciences. About a third of all medical schools require a year of college mathematics and some specify calculus, statistics, or computer science. For a complete listing of these and any additional course requirements set by each school, consult *Medical School Admissions Requirements*, published by the Association of American Medical Colleges or *Admission Requirements of U.S. and Canadian Dental Schools*, published by the American Association of Dental Schools. These and similar resources for schools of optometry and veterinary medicine are located in the Health Professions Advising Office. Students should discuss their programs of study with their major advisors, academic deans, and with the advisor for the health professions.

**Graduate Programs in the Health Professions.** Students interested in careers as physical therapists, health administrators, or others of the allied health professions should prepare with course work in the natural sciences and behavioral sciences within a liberal arts curriculum. Descriptive literature on each of the allied health schools and professions is part of the library maintained in the Health Professions Advising Office. Students will also find publications of selected advanced degree programs in biomedical research, including the combined M.D./Ph.D. degree programs.

**Law Schools.** Students who plan to prepare for law school and a career in law should seek breadth in their undergraduate course program with specialization in one or more areas. They may choose virtually any field for their major work. Though no specific courses are required, prelaw students have often chosen from among the following: Management Sciences 53; Economics 1, 2; English 101S; History 21, 22, 91, 91S, 92, 92S, 207, 208, 241-242; Philosophy 48; Political Science 91, 127, 207S; Public Policy Studies 55; Sociology 10 and 157.

For a fuller discussion of undergraduate preparation for the study of law, students should refer to the *Duke Prelaw Handbook* or the *Prelaw Handbook* published by the Association of American Law Schools and the Law School Admission Council, or consult the prelaw advisor in the college.

**Theological Schools and Religious Work.** Students contemplating theological study should correspond at the earliest opportunity with the appropriate schools and with the authorities of their churches to learn how to prepare for the specific programs they expect to enter. Probably, they will find that they should consider the following subjects: English language and literature; history, including non-Western cultures as well as European and American; philosophy, particularly its history and its methods; natural sciences, both the physical and the life sciences; psychology, sociology, and anthropology; the fine arts and music; biblical and modern languages; religion, both in the Judaeo-Christian and in the Near and Far Eastern traditions. Some seminaries require Greek or Hebrew for admission. It is the understanding gained in these fields rather than the total number of credits or semester hours earned which is significant. More detailed information about theological education, not limited to Duke, may be obtained from the Director of Admissions of the Divinity School.

## The School of Engineering

Duke University offers in the School of Engineering programs of study which lead to the degree of Bachelor of Science in Engineering. Four programs are accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET). These programs are biomedical engineering, civil engineering, electrical engineering, and mechanical engineering. These accredited programs, and special programs of study in interdisciplinary fields, are offered by the Departments of

Biomedical Engineering, Civil and Environmental Engineering, Electrical Engineering, and Mechanical Engineering and Materials Science.

For graduation with a Bachelor of Science in Engineering degree, a student must complete successfully a minimum of thirty-four semester courses. These thirty-four semester courses must include the following:

### General Requirements\*

Writing . . . . .	1 s.c.	This requirement is met by completing a University Writing Course.
Mathematics . . . . .	4 s.c.	This requirement is met by completing Mathematics 31†, 32†, and 103; plus 104 or 111 or 135.
Natural Science . . . . .	4 s.c.	This requirement is met by completing Chemistry 11, Physics 51 and 52, and an elective course in one of the natural science departments which presents fundamental knowledge about nature and its phenomena, preferably including quantitative expression.‡
Social Sciences and Humanities . . . . .	5 s.c.	This requirement is met by completion of five courses from at least two departments, one in the humanities and one in social sciences. One course must be 100-level or above. This program of courses should reflect a rationale or fulfill an objective appropriate to the engineering profession. Courses selected must be those which present essential subject matter and substance of the discipline; for example, no introductory skill courses may be used to satisfy this requirement. Likewise, courses devoted primarily to subjects such as accounting, management science, industrial management, finance, personnel administration, introductory language, and ROTC normally do not fulfill this objective regardless of their general value in the total engineering curriculum. Courses taught in professional schools may not be used to satisfy this requirement.

\*House courses cannot be used to meet Bachelor of Science in Engineering degree requirements.

†Mathematics 33 and 34 are acceptable in lieu of Mathematics 31 and 32.

‡Courses in mathematics, statistics, and computer science will not meet this requirement. A list of disallowed courses is maintained in the Dean's office.





Engineering and Applied Sciences ..... 4 s.c. This requirement is met by completion of one course from each of four of the following six areas: electrical science, information and computer science, mechanics (solid and fluid), materials science, systems analysis, and thermal science and transfer processes. See departmental requirements, which follow, for any specific courses to be included.

Digital Computation ..... Students are expected to have acquired digital-computer programming capability before their sophomore year. The programming capability may be satisfied by prior experience or by passing Engineering 51, Engineering 52, Computer Science 51, or Computer Science 53.

**Departmental Requirements**

Departmental Specifications ..... 16 s.c. The department administering the major field of study will specify this requirement. In general, it will consist of both required courses and electives to be planned in consultation with the departmental advisor. Including the 4 s.c. in engineering and applied sciences listed under general requirements, a total of 8.5 s.c. equivalents in engineering science and 4.25 s.c. equivalents in engineering design are required. See the individual departmental requirements, which follow.

\*Total Minimum Requirement ..... 34 s.c.

\*A maximum of two semester courses of junior or senior level air science, military science, or naval science course work may be counted in satisfying the minimum requirements of thirty-four semester courses for a baccalaureate degree in engineering. These courses must be included in the sixteen semester courses listed under departmental requirements. All other courses completed in air, military, or naval science are taken in addition to the minimum program.

**Biomedical Engineering Departmental Requirements**

All general requirements and departmental requirements comprising the accredited biomedical engineering major are incorporated in the following sequence, only one of several possible sequences. The student is encouraged to choose electives and select a sequence which develops broad intellectual interests.

**Freshman Year**

First Semester	Courses	Second Semester	Courses
Chemistry 11	.....1	Chemistry 12	.....1
University Writing Course	.....1	Physics 51	.....1
Mathematics 31	.....1	Mathematics 32	.....1
Engineering 51 or Social Science or Humanities Elective	..... <u>1</u>	Social Science or Humanities Elective or Engineering 51	..... <u>1</u>
	4		4

**Sophomore Year**

First Semester	Courses	Second Semester	Courses
Physics 52	.....1	Biomedical Engineering 163	.....1
Electrical Engineering 61	.....1	Elective	.....1
Mathematics 103	.....1	Mathematics 111	.....1
Social Science or Humanities Elective	.....1	Social Science or Humanities Elective	..... <u>1</u>
Elective	..... <u>1</u>		4
	5		

## Junior Year

First Semester	Courses	Second Semester	Courses
Biomedical Engineering 110 .....	1	Biomedical Engineering 145 .....	1
Biomedical Engineering 101 .....	1	Life Science Elective .....	1
Electrical Engineering 112 or Biomedical Engineering 171 .....	1	Biomedical Engineering 164 .....	1
Elective .....	<u>1</u>	Biomedical Engineering Elective .....	<u>1</u>
	4		4

## Senior Year

First Semester	Courses	Second Semester	Courses
Biomedical Engineering 207 .....	1	Biomedical Engineering Elective .....	1
Biomedical Engineering Elective .....	1	Biomedical Engineering Elective .....	1
Life Science Elective .....	1	Elective .....	1
Social Science or Humanities Elective .....	1	Social Science or Humanities Elective .....	1
Elective .....	<u>1</u>		<u>4</u>
	5		

Premedical students should schedule Chemistry 151, 152, and two life science electives before the end of their junior year by deferring some required courses to the senior year. Biomedical engineering electives include all courses with biomedical engineering numbers other than required courses.

## Civil And Environmental Engineering Departmental Requirements

The general requirements and departmental requirements comprising the accredited civil engineering major are all incorporated in the following typical program.

### Freshman Year

First Semester	Courses	Second Semester	Courses
Chemistry 11 .....	1	Engineering 24 .....	1
Mathematics 31 .....	1	Mathematics 32 .....	1
University Writing Course .....	1	Physics 51 .....	1
Engineering 51 or 52 or Social Science-Humanities Elective .....	<u>1</u>	Social Science-Humanities Elective or Engineering 51 or 52 .....	<u>1</u>
	4		4

### Sophomore Year

First Semester	Courses	Second Semester	Courses
Engineering 75 .....	1	Engineering 123 .....	1
Mathematics 103 .....	1	Mathematics 111 .....	1
Physics 52 .....	1	Natural Science Elective .....	1
Social Science-Humanities Elective .....	<u>1</u>	Elective .....	<u>1</u>
	4		4

### Junior Year

First Semester	Courses	Second Semester	Courses
Civil Engineering 122 .....	1	*Civil Engineering Elective .....	1
Civil Engineering 131 .....	1	*Civil Engineering Elective .....	1
Social Science-Humanities Elective .....	1	Social Science-Humanities Elective .....	1
Statistics 100 .....	1	Elective .....	<u>1</u>
Elective .....	<u>1</u>		4
	5		

### Senior Year

First Semester	Courses	Second Semester	Courses
†Advanced Civil Engineering Elective .....	1	†Advanced Civil Engineering Elective .....	1
*Civil Engineering Elective .....	1	*Civil Engineering Elective .....	1

\*These five courses shall be chosen from the following: Civil Engineering 116, 123, 124, 133, 134, 139, and Engineering 150.

†Any 200-level civil engineering course.

*Civil Engineering Elective	1	Elective	1
Social Science-Humanities Elective	1	Elective	1
Elective	<u>1</u>		<u>4</u>
	5		

\*These five courses shall be chosen from the following: Civil Engineering 116, 123, 124, 133, 134, 139, and Engineering 150.

In order to satisfy the School of Engineering distributional requirements of four courses in engineering and applied science, the student must take at least two courses from the following: Engineering 83, Engineering 101, Electrical Engineering 61, or Civil Engineering 215.

### Electrical Engineering Departmental Requirements

The general requirements and departmental requirements comprising the accredited electrical engineering major are all incorporated in the following program. This program is presented as a guide to assist students in planning their four-year program and should not be viewed as an inflexible sequencing of courses.

#### Freshman Year

First Semester	Courses	Second Semester	Courses
Mathematics 31	1	Mathematics 32	1
Chemistry 11	1	Physics 51	1
University Writing Course	1	Approved Elective	1
Engineering 51 or Computer Science 51 or Social Science-Humanities Elective	<u>1</u>	Engineering 51 or Computer Science 51 or Social Science-Humanities Elective	<u>1</u>
	4		4

#### Sophomore Year

First Semester	Courses	Second Semester	Courses
Electrical Engineering 61	1	Electrical Engineering 62	1
Mathematics 103	1	Electrical Engineering 112	1
Physics 52	1	Mathematics 104, 111, or 135	1
Social Science-Humanities Elective	<u>1</u>	Social Science-Humanities Elective	<u>1</u>
	4		4

#### Junior Year

First Semester	Courses	Second Semester	Courses
*Electrical Engineering	1	*Electrical Engineering	1
*Electrical Engineering	1	*Electrical Engineering	1
†Mathematics	1	‡Natural Science	1
Social Science-Humanities Elective	<u>1</u>	Approved Elective	<u>1</u>
	4		4

\*These four courses must be chosen from the following: Electrical Engineering 103, 143, 157, 161, 186, 199.

†Any 100-level math course except 123, 128, 150, or 183.

‡One of the following: Chemistry 12; Physics 105, 161, 176S, 181, and 185; Biology 14 is recommended.

#### Senior Year

First Semester	Courses	Second Semester	Courses
Approved Electrical Engineering Elective	1	Approved Electrical Engineering Elective	1
Approved Electrical Engineering Elective	1	Social Sciences-Humanities Elective	1
Approved Elective	1	Approved Elective	1
Approved Elective	1	Approved Elective	1
*Approved Elective	<u>1</u>	*Approved Elective	<u>1</u>
	5		5

\*May be taken during junior year.

*Note:* The selection of approved electives should take into account a departmental requirement that a student must have accumulated by graduation time the equivalent of

4.25 engineering design and 8.5 engineering science courses. Engineering 23, Engineering 174, and Engineering 175 may not be counted toward the departmental requirement.

In order to satisfy the School of Engineering distributional requirement of four courses in engineering and applied science, the student may use Electrical Engineering 61 as an electrical science course and Electrical Engineering 112 as a systems analysis course. The remaining two courses may be selected from any two of the following areas: information and computer science (Engineering 51 or Computer Science 51 may be used to satisfy this requirement), mechanics, materials science, and thermal sciences.

An up-to-date list of acceptable *engineering design* and *engineering science* courses may be obtained from the departmental office.

### Mechanical Engineering and Materials Science Departmental Requirements

The general requirements and departmental requirements comprising the accredited mechanical engineering major are all incorporated in the following program. This sequence of the courses is presented as an overview of the program and is one of two recommended sequences of the course requirements.

#### Freshman Year

First Semester	Courses	Second Semester	Courses
Mathematics 31 .....	1	Mathematics 32 .....	1
Chemistry 11 .....	1	Physics 51 .....	1
University Writing Course .....	1	Engineering 83 .....	1
Engineering 51 .....	1	*Elective .....	1
	<u>4</u>		<u>4</u>

#### Sophomore Year

First Semester	Courses	Second Semester	Courses
Mathematics 103 .....	1	Mathematics 111 .....	1
Physics 52 .....	1	Engineering 101 .....	1
Engineering 75 .....	1	Engineering 123 .....	1
*Elective .....	1	*Elective .....	1
*Elective .....	1	*Elective .....	1
	<u>5</u>		<u>5</u>

#### Junior Year

First Semester	Courses	Second Semester	Courses
Engineering 130 .....	1	Mechanical Engineering 141 .....	1
Mechanical Engineering 120 .....	1	Mechanical Engineering 150 .....	1
Mechanical Engineering 126 .....	1	Mathematics 114 .....	1
Mechanical Engineering 115 .....	1	Physics 171 .....	1
	<u>4</u>		<u>4</u>

#### Senior Year

First Semester	Courses	Second Semester	Courses
Mechanical Engineering 160 .....	1	Mechanical Engineering Elective .....	1
Mechanical Engineering Elective .....	1	†Technical Elective .....	1
†Technical Elective .....	1	*Elective .....	1
*Elective .....	1	*Elective .....	1
	<u>4</u>		<u>4</u>

\*Part of a program of approved electives planned with the student's faculty advisor to suit individual interests and abilities. The program must include five social science-humanities courses selected to meet the general requirements as stated on page .

†One of two electives restricted to the areas of engineering, mathematics, or natural sciences. A list of disallowed courses is maintained in the departmental office.



The major requirements are included in the minimum total of thirty-four courses listed under general requirements and departmental requirements. Specific courses which must be included are Engineering 75, 83, 101, 123, and 130; Mechanical Engineering 115, 120, 126, 141, 150, and 160.

**Declaration of Major.** A student is urged to declare a major by the time of registration for the first semester of the sophomore year, but is required to do so by the time of registration for the first semester of the junior year. Declaration of major is accomplished by completing a form available in the Office of the Dean of Engineering.

**Double Major.** If an engineering student completes simultaneously the requirements for a departmental major in arts and sciences and the requirements for a Bachelor of Science in Engineering degree, or satisfies simultaneously the requirements for two engineering majors, the official record will indicate this fact. However, the Director of Undergraduate Studies for the second major must certify that the departmental major requirements have been met. The student must initiate the procedure, either through the Dean of the School of Engineering or through the Director of Undergraduate Studies in the second department. The completion of the requirements for the major in this department must be confirmed no later than the time of registration for the final semester. Courses which are common to both majors shall be counted toward satisfying the requirements of both majors.

**Interdisciplinary Programs in Engineering.** These programs parallel the major programs in biomedical, civil, electrical, and mechanical engineering, but are not individually accredited by ABET. They provide special opportunities for study in interdisciplinary fields, such as energy conversion, biochemical engineering, engineering mechanics, materials science, ocean engineering, pollution control, systems and controls, and urban engineering, leading to the Bachelor of Science in Engineering degree, which may be arranged with approval of the engineering faculty. Any student, in consultation with the advisor or another faculty member, may propose a unique combination of courses designed to meet particular career objectives. The proposal should be submitted to the Engineering Faculty Council, through the Dean of the School of Engineering, for approval; it may be submitted as early as the second semester of the freshman year and must be submitted before the beginning of the senior year. The proposal should include the student's reasons for pursuing the suggested program of study, and it must show how the proposed courses satisfy the following requirements:

1. The proposed program of study meets the general requirements for the Bachelor of Science in Engineering degree but cannot be accommodated by the approved departmental requirements in biomedical, civil and environmental, or electrical engineering, or mechanical engineering and materials science.
2. A program of at least eight engineering courses is included to provide depth in the chosen interdisciplinary area of study.
3. A program of at least five courses, in addition to the seventeen courses listed under general requirements, is included to provide breadth in technical areas (engineering, natural science, and mathematics).
4. The remaining courses, which are treated as electives, require the approval of the student's advisor.

Each student enrolled in an approved interdisciplinary program will be assigned to the appropriate engineering department for administrative purposes.

**Bachelor of Science in Engineering/Master of Science Program.** This program provides students with an opportunity to plan a coordinated five-year program of studies in the School of Engineering leading to both the Bachelor of Science in Engineering and Master of Science degrees. Application for admission to this integrated program may be made during the junior or senior year. Provisional admission to the Graduate School may be granted when the student enrolls for the semester during which the Bachelor of Science



in Engineering degree requirements will be completed. Graduate level courses during this period which are in excess of Bachelor of Science in Engineering requirements may be credited toward fulfillment of the Master of Science degree requirements.

Students must complete thirty semester hours of credit specifically approved for the Master of Science degree under the prevailing graduate rules; up to six of these hours may be thesis research if the program includes a written master's thesis. No more than nine semester hours of graduate work can be completed concurrently with completing the Bachelor of Science in Engineering degree requirements.

**Residence Requirements.** At least seventeen semester courses must be completed satisfactorily at Duke. This must include the work of the final two semesters, with the following exceptions: the student who has completed more than four full semesters of work at Duke may take the last two courses elsewhere; others may take the last course elsewhere. The courses taken elsewhere must be approved in advance by the student's major advisor and academic dean.

**Pass/Fail Grading Option.** With the consent of the instructor and the faculty advisor, an engineering student may choose to be graded on a pass/fail basis in up to four unrestricted electives or social sciences-humanities electives within the thirty-four-course program. A student may take no more than one course on a pass/fail basis each semester.

**Repetition of Courses.** An engineering student who has earned a grade of *D-*, *D*, or *D+* in a required mathematics course or a required engineering course may, with permission of his or her advisor, Director of Undergraduate Studies, and academic dean, repeat the course. Both grades will remain on the student's record. Only one credit may be counted toward fulfilling graduation requirements.

**Annual Recognition.** In acknowledgment of high academic achievement, recognition is given each summer to freshmen, sophomores, juniors, and seniors if the following requirements are met:

1. A normal academic load has been carried in the fall and spring terms.
2. Grades other than *P* have been earned in six semester courses.
3. No incomplete or failing grade has been received during the fall and spring terms.

The *Dean's List* recognizes students who earn a 3.3 average on all work in both the fall and spring terms. The *Dean's List with Distinction* includes students who earn a 3.6 on all work in both the fall and spring terms of an academic year.

**Continuation Requirements.** A student must achieve a satisfactory record of academic performance each semester and make satisfactory progress toward graduation to remain enrolled in the University.

A student must pass at least three courses in each semester, except for the first semester of the freshman year, in which at least two courses must be passed. A student who fails to meet this continuation requirement must leave the University for at least two semesters. A complete summer session may be counted as a semester. Following application for readmission, return must be approved by the Dean and the Director of Undergraduate Studies in the student's major department. If the student thereafter fails to pass three courses in a semester, permanent dismissal from the University usually results. A student who enrolls in more than four courses in a given semester and fails two or more of them will not be permitted to enroll for more than four courses in the following semester without approval of the Dean. In addition, a student may be dismissed temporarily or permanently for failing to make satisfactory progress toward graduation, including satisfactory progress toward fulfillment of curricular requirements within ten semesters.

The term *satisfactory progress* shall be defined also by the following schedule:

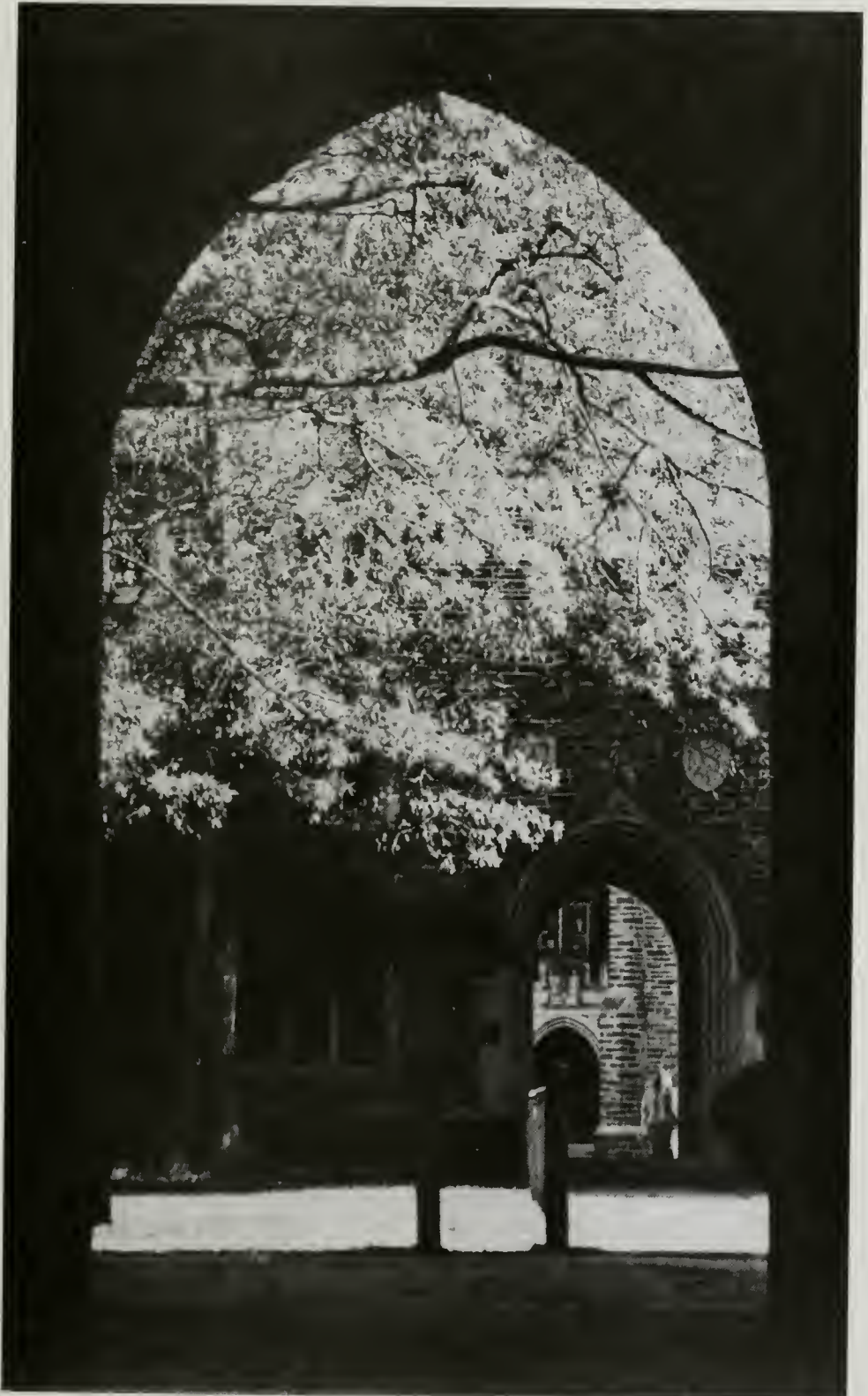
1. To begin enrollment in the second year, a student must have passed 6 s.c. and earned *P*, *C-*, or better in 4 s.c.\*

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\*Continuation from the first to second year shall be based only on course credits earned at Duke and credits received through the Advanced Placement program.

2. To begin enrollment in the third year, a student must have passed 13 s.c. and earned *P*, *C-*, or better in 11 s.c.
3. To begin enrollment in the fourth year, a student must have passed 20 s.c. and earned *P*, *C-*, or better in 18 s.c.
4. To begin enrollment in the fifth year, a student must have passed 27 s.c. and earned *P*, *C-*, or better in 25 s.c.

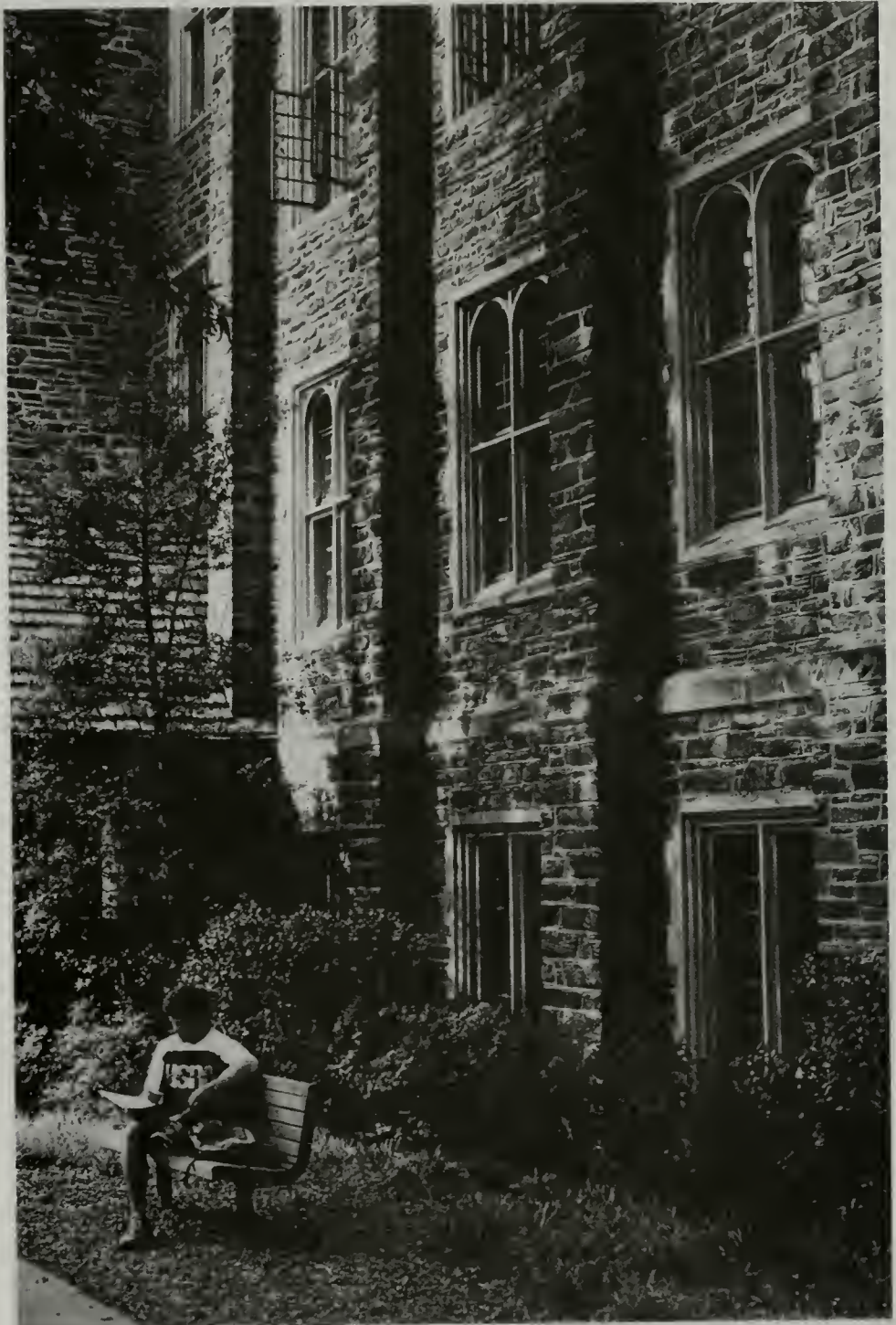
**Grade Requirement for Graduation.** Of the thirty-four semester courses which fulfill the specified categories in the Bachelor of Science in Engineering degree requirements, thirty-two or their equivalent in number must be passed with grades of *P*, *C-*, or better.





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*Academic Procedures and Information*





## Advanced Placement

Scores on the tests discussed below and documented previous educational experience are the criteria used to determine a student's qualifications for certain advanced courses. If questions arise, students should consult the Director of Undergraduate Studies in the appropriate department or the University Registrar.

**College Board Advanced Placement Program (APP) Examinations.** A score of 4 or 5 on College Board Advanced Placement Program Examinations, taken prior to matriculation in college, is the basis for consideration for credit and/or placement in advanced courses in art, biology, chemistry, computer science, English,\* French, German, history, Latin, music, physics†, political science, and Spanish. The Department of Mathematics will consider a score of 3 for placement beyond the introductory course. The record of a student presenting such a score and desiring to continue in the same subject at Duke will be evaluated for credit and for placement in an advanced course. Departmental policies regarding advanced placement and credit may vary. In the case of French, German, Latin, and Spanish, APP scores of 4 or 5 may result in placement in courses at the 100 level; approval of the Director of Undergraduate Studies or Supervisor of Freshman Instruction in the appropriate department is required before final placement is made. Credit may be granted for one or two courses in each subject area, with the approval of the academic department concerned. Also, see the section on residence requirements in the chapter "Degree Programs."

**College Board Achievement Tests.** Scores on College Board Achievement Tests are the basic criteria for placement in French, German, Italian, Spanish, Latin, and mathematics. Course credit is not given for courses bypassed. The following tables will assist students in making reasonable course selections in the subjects indicated.

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\*The score in English Advanced Placement, although qualifying a student for advanced courses in literature, does not satisfy the requirement in Writing.

†In order to receive credit for Physics 51 or 52, a student must take a validation test during orientation.

French*		German		Italian	
College Board Achievement Scores		College Board Achievement Scores		College Board Achievement Scores	
200-370	French 1-2	200-390	German 1†	200-440	Italian 1-2
380-440	French 12	400-480	German 65-66	450-540	Italian 63
450-540	French 63	490-560	German 63	550-590	Italian 76
550-590	French 76	570 plus	Third year‡	600 plus	Italian 100-level course
600	French 100-level course§				
Spanish*		Latin		Mathematics#	
200-420	Spanish 1-2	200-520	Latin 1	200-480	Math. 9-10
430-490	Spanish 12	530-630	Latin 63	490-540	Math. 19
500-570	Spanish 63	640 plus	Third year‡	550-580	Math. 31A
580-620	Spanish 76			590-800	Math. 31 or 33, or with one year of high school calculus, Math. 41
630 plus	Spanish 100-level course§				

\*In these languages students are permitted to drop back one level without loss of credit (e.g., from 101 to 76 or from 76 to 63). No credit will be allowed for courses two levels below the achievement score (e.g., students with a score of 640 in French or Spanish could not receive credit for 63, but could for 76). In no case will credit be given for 1-2 to students with three or more years of high school French or Spanish.

†The first year of a language may *not* be taken for credit by a student who has completed more than two years of that language in secondary school. In rare cases, an exception may be granted with permission of the Director of Undergraduate Studies in the appropriate department.

‡An exception may be granted in consultation with the Director of Undergraduate Studies.

§French 111 and Spanish 110 are not open to first semester freshmen with a score of less than 700.

#In the absence of an Achievement Test score, course placement is determined by the SAT score as follows: 490 or below—Math. 9-10; 500-600—Math. 19; 610-650—Math. 31A; 660-800—Math. 31 or 33. Math. 31A refers to special sections of Math. 31 which provide students more instructional time.

**College Board College Placement Tests.** Newly admitted students who wish to continue in a language which was begun in high school should be sure to take a College Board Achievement Test in that language by June of the senior year in secondary school. A student who finds that it is not possible to take a foreign language achievement test may petition to take a placement test at Duke University during orientation. In such cases, the student should write to the Coordinator of Placement Testing at Counseling and Psychological Services by July 1, explaining why it is not possible to take the achievement test. Taking the tests under these circumstances is necessary to determine whether the student has demonstrated foreign language proficiency at entrance or, if not, what placement level at Duke is most appropriate to his or her needs.

All freshmen who plan to take mathematics during their first semester at Duke, and who do not submit the College Board SAT score or College Board Achievement Test score in mathematics, must take the College Board College Placement Test in mathematics during orientation. Students who have been placed in Mathematics 9-10, 19, or 31 but believe

that their background in mathematics justifies a higher course placement need not take the College Board College Placement Test, but they should consult the Director of Undergraduate Studies or Supervisor of Freshman Instruction in the Department of Mathematics. Course credit is not given for courses bypassed on the basis of the placement tests.

**International Baccalaureate (IB) Program.** Duke University was one of the first institutions of higher learning in this country to recognize the International Baccalaureate Program. Currently, advanced standing credit and/or placement can be awarded upon the recommendation of the Duke department concerned. Scores of "6" and "7" earned at the higher level are acceptable for consideration.

**Placement in Russian.** Students who wish to continue in Russian at Duke should see the Director of Undergraduate Studies in the Department of Slavic Languages and Literatures. In the case of Russian, either College Board Achievement Test scores or College Board Placement Test scores serve as criteria for placement. Lacking these, the department offers an examination which is used in conjunction with other criteria for placing students at the appropriate course level.

**Reading Out of Introductory Courses.** Students demonstrating academic ability may be granted the option of reading out of an introductory or prerequisite course in order to allow them to advance at their own pace to upper level work. No course credit may be earned by reading out. Reading for a course and auditing are mutually exclusive procedures. Students must be recommended for the reading option by their academic deans, and their proposed programs of reading must be approved by the appropriate Director of Undergraduate Studies. Students may be certified for advanced course work by passing a qualifying examination prepared by the department. When an advanced course is completed, an entry is made on the permanent record that the qualifying examination was passed, but no course credit is awarded. Further information is available from the academic deans.

## Transfer of Work Elsewhere

**Evaluation of Work Taken Elsewhere.** For students transferring from another accredited, degree-granting institution, credit for up to seventeen semester courses may be granted (sixteen for those who matriculated prior to May 1, 1988.) Courses in which grades of less than C- have been earned are not accepted for transfer credit; students seeking transfer credit for courses in which they earned a *P* grade must present official verification that the *P* is equivalent to at least a C- grade. The semester-course unit of credit awarded at Duke for satisfactorily completed courses cannot, of course, be directly equated with semester-hour or quarter-hour credits. Ordinarily, transfer students will not be awarded more than four semester-course credits for one semester's work unless they have satisfactorily completed more than the normal course load at the institutions from which they have transferred. All courses approved for transfer are listed on the student's permanent record at Duke, but grades earned are not recorded. Courses taken at other institutions prior to matriculation at Duke are evaluated by the University Registrar and by the faculty.

**Limitation on Work Taken Elsewhere.** After matriculation as a full-time degree candidate in Trinity College of Arts and Sciences, a student may receive credit toward the Bachelor of Science or Bachelor of Arts degree for a maximum of two courses taken at another institution, whether in the summer while regularly enrolled at Duke, while withdrawn voluntarily from the college, or while on leave of absence (other than for an approved program of study abroad or an approved program at another institution in the United States). Full-time degree candidates in the School of Engineering may receive credit towards the Bachelor of Science in Engineering degree for a maximum of four courses taken at another institution. Ordinarily, no credit will be accepted for course work taken



while a student is withdrawn involuntarily. For purposes of this regulation, advanced placement credit is not considered as work taken at another institution. The provision of the residence requirement which allows a student to take the final courses elsewhere remains in effect. See the section on residence requirements in the chapter "Degree Programs."

Students may not transfer credit from two-year colleges after completing their sophomore year. At least half the courses submitted toward fulfillment of a student's major field must be taken at Duke, but departments may make exceptions to this rule in special circumstances. No credit is given for work completed by correspondence, and credit for not more than two semester courses is allowed for extension courses.

**Approval for Courses Taken Elsewhere.** Approval forms for courses to be taken at institutions other than Duke may be obtained from the offices of the academic deans. Students wishing to transfer credit for study at another accredited college while on leave or during the summer must present a catalog of that college to the appropriate dean and Director of Undergraduate Studies and obtain their approval *prior* to taking the courses.

## Advising

Students and their advisors confer when necessary, but they should confer at least once before every registration period to review goals, plans for achieving them, and any problems encountered or anticipated. Before declaring a major in Trinity College, students confer with the premajor advisor, the academic dean for premajor students, or the academic dean in the division of their interests. Upon declaring a major, the student is assigned a faculty advisor; the academic dean for that division is also available for consultation. In the School of Engineering, the advisor's signature is necessary for registration and all course changes. Much good advising is informal and occurs in conversation with members of the faculty. Students have the responsibility to understand and meet the requirements for the curriculum under which they are studying and should seek advice as appropriate.

## Registration

Students are expected to register at specified times for each successive term. Prior to registration each student receives special instructions and registration materials. Students prepare a course program, submit it at an appointed time to their advisors for review, and present the approved schedule at registration. In the School of Engineering, the schedule must be signed by the advisor.

Students who expect to obtain certification to teach in secondary schools should consult an advisor in the education program prior to each registration period to ensure that they are meeting requirements for state certification and that they will have places reserved for them in the student teaching program.

Those who register late are subject to a \$50 fine. Students who fail to register for the fall or spring semester are withdrawn and must apply for readmission if they wish to return; they also forfeit their registration deposits unless they indicate at the time of registration their intention not to continue in the University the following term. Those students who have not paid any fees owed to or fines imposed by the University (such as laboratory fees, library fines, and parking fines) by the date specified for registration for the following term will not be permitted to register for the following term until such fees and fines have been paid in full, notwithstanding the fact that the student may have paid in full the tuition for the following term.

Students planning to register for a course under the reciprocal (interinstitutional) agreement must have the course approved by the appropriate Director of Undergraduate Studies and their academic dean. Further information about registration procedures once approval is given may be obtained from the Office of the Registrar. See the chapter "Special Programs" for information regarding the reciprocal agreement with neighboring universities.



**Duke Identification Card and Term Enrollment.** Students are to report to 103 Allen Building at the beginning of each term to obtain semester validation of their Duke I.D. card. This card should be carried at all times. The identification card with proper validation is means of identification for library privileges, University functions, and services available to University students. Students are expected to present their card on request to any University official or employee. The card is not transferable, and fraudulent use may result in loss of student privileges or suspension. Loss of the card should be reported immediately to the Office of the Registrar where new ones can be obtained for \$5. Official enrollment is required for admission to any class. Failure to report, or to account beforehand for an absence, entails a loss of registration in courses.

**Concurrent Enrollment.** A student enrolled at Duke may not enroll concurrently in any other school or college without special permission of the appropriate academic dean. See, however, the statement regarding the reciprocal agreement with the University of North Carolina at Chapel Hill, North Carolina Central University in Durham, and North Carolina State University at Raleigh.

**Course Changes after Classes Begin in the Fall and Spring Terms.** During the drop/add period changes may be made in course schedules. Receipts for course changes made in 103 Allen Building must be retained.

In Trinity College of Arts and Sciences, students may drop and add courses during the first week of classes in the fall and spring terms at their own discretion; during the second week of the drop/add period they may drop courses at their own discretion, but the signature of the appropriate instructor is required for adding a course. After the drop/add period no course may be added; also, a course may not be changed to or from the pass/fail or audit basis. To withdraw from a course, students must obtain permission from their academic deans, and for reasons of course overload the academic dean may give permission up to midterm. Ordinarily, courses may not be discontinued after midterm. In extraordinary circumstances, however, e.g., for reasons of health, the academic dean may allow a student to withdraw. After the drop/add period, the student receives a *WP* grade (withdraw passing) or *WF* (withdraw failing) from the instructor. Course work discontinued without the dean's permission will ordinarily result in a grade of *F*.

Within the School of Engineering, the signature of the advisor is necessary for dropping or adding courses after classes begin. After the drop/add period no course may be added, and in order to withdraw from a course students must obtain permission from their academic deans. Factors to be considered by the dean include health, necessary outside work, and, up to the time midterm grades are issued, a course overload. Until the last four weeks of classes in the semester, the instructor must certify the student's standing in the course as satisfactory or as failing. In the former case a *WP* will be entered on the permanent record and in the latter, a *WF*. During the last four weeks of classes in any semester, or the equivalent in the summer terms, *W* will be assigned if, in the judgment of the student's dean, compelling and extraordinary circumstances make it necessary for the student to drop the course; otherwise, the course must be continued to the end of the semester. A course discontinued without approval will result in a grade of *F*.

When students note an error in their course schedules, they should consult with their academic dean.

**Course Changes for the Summer Terms.** Course changes are accomplished by submitting the three-part drop/add form(s) to the Office of the Summer Session, 121 Allen Building. Beginning May 9, all course changes must be approved by the appropriate academic dean. The Director of the Summer Session serves as the dean for all non-Duke students. Students who are out of town must contact their academic dean directly to arrange for dropping or adding courses.

Courses may be added before or during the first three days of the term (see also the section on late registration and payment). After the third day of the term, no course may be added. Prior to the first day of the term, students may drop a course or courses for which

they have registered without penalty. During the first three days of the term, students will be charged \$150 per course (\$75 per half-course) for dropping a course or courses if this results in any reduction in course load for the term. With the permission of the academic dean a course may be dropped until the end of the fourteenth day of a regular summer term (eleventh day at the Marine Laboratory); the instructor then assigns a *WP* or *WF* grade. Course work discontinued without the approval of the dean will result in a grade of *F*. (See also the section on Withdrawal Charges and Refunds.)

## Course Load and Eligibility for Courses

Students are reminded that it is their responsibility to be certain that their course load conforms with academic requirements. The normal and expected course load in the fall or spring term is four semester courses. For students matriculating after May 1, 1988, two additional semester credits are needed in order to meet the thirty-four (34) semester-course requirement for graduation. To take fewer than four or more than five semester courses, students must have the approval of their academic deans. No student, however, may take more than six courses in any semester. With the approval of their academic dean, seniors in Trinity College and the School of Engineering who need fewer than eight semester courses for graduation requirements may take an underload.

Maximum course program for one term of the summer session is two courses, one of which may be a laboratory course. Students in the School of Engineering may enroll in two laboratory courses. In addition, a student may enroll in a physical education activity or dance activity course for one-half course credit.

Self-pacing during a given calendar year (two regular semesters plus two Duke summer terms) is possible with the approval of the student's academic dean and faculty advisor (and in consultation with the Office of Undergraduate Financial Aid, if the student is receiving monetary support from the University). Prior to the beginning of a semester, a student may apply to take fewer than four courses for one or more semesters in a given calendar year after the freshman year, providing the student can meet the continuation requirements described in the chapter "Degree Programs." Advanced placement credits and summer work taken elsewhere are excluded when minimum annual continuation requirements are considered under this plan.

*Eligibility for Courses.* The rules established by the Graduate School provide that juniors and well-qualified sophomores may enroll in a 200-level (senior-graduate) course if they have obtained written consent of the instructor, as well as that of the Director of Graduate Studies in the department concerned. Undergraduate students may not enroll in 300- or 400-level courses.

Seniors who, at the beginning of the final term, lack no more than three semester courses toward the fulfillment of the requirements for the Bachelor of Arts or Bachelor of Science degree may enroll in graduate courses, for a maximum course load of five semester courses. Admission to the Graduate School is necessary.

Students may not register for two courses meeting at the same time. In Trinity College no course may be repeated for credit or a grade if a C- or higher has been earned previously, except where noted in the course description. A course previously passed, however, may be audited.

Students who receive a D-, D, or D+ in any course in Trinity College are allowed to repeat the course at Duke. The grade earned in the repeated course as well as the grade earned originally appear on the transcript, the former identified as a repeat; both grades count in the grade point average, but the credit for only one counts toward the required number of courses for continuation and the thirty-four (34) courses required for graduation.

## Course Audit

Students who audit a course submit no daily work and take no examinations. They do not receive credit for the course. With the written consent of the instructor, a full-time

degree student is allowed to audit one or more courses in addition to the normal program. Physical education activity, studio art, applied music, and dance activity courses may not be audited. In the fall or spring term, a part-time degree student may audit courses by payment for each course audited. In a summer term, a student carrying two courses for credit may be given permission to audit, without additional fees, nonlaboratory courses with the above exceptions. A student in a summer term carrying less than a full program for credit may secure permission to audit (above exceptions apply) but is required to pay half the University fee for the course. After the drop/add period in any term, no student classified as an auditor in a particular course may take the course for credit, and no student taking a course for credit may be reclassified as an auditor. A student may not repeat for credit any course previously audited.

Courses may be audited by faculty members, staff, alumni, employees and their spouses, as well as spouses of currently enrolled students, and members of the Institute for Learning in Retirement; courses audited on the Microelectronics Center of North Carolina (MCNC) Network may be audited without concurrent enrollment in another course. Formal application is not necessary; written permission from the instructor must be obtained and a course card must be signed by the Director of the Office of Continuing Education. Consult the chapter "Financial Information" for the appropriate fee schedule. Auditors must register on the Friday before classes begin.

## **Independent Study**

Independent study enables a student to pursue individual research and reading in a field of special interest under the supervision of a member of the faculty. A student—with the approval of an advisor, the instructor, and the Director of Undergraduate Studies in the instructor's department—may enroll in independent study for any term at Duke. In Trinity College, instructors of independent study courses are expected to meet with the students enrolled at least once every two weeks during the fall or spring and at least once each week during a summer term.

## **House Courses**

House courses, offered in the fall and spring terms, are organized by students within given residential units. They are intended to encourage students to take initiative in creating academic experiences that are not offered by the departments. A house course must be sponsored by a faculty member in the arts and sciences, reviewed by the department of that faculty member, and approved by the Committee on Courses of Instruction of the Undergraduate Faculty Council of Arts and Sciences. House courses carry a half-course credit. In the School of Engineering, house courses cannot be used to meet degree requirements. In Trinity College not more than two semester-course credits earned in house courses can be counted toward the course requirement for graduation. House courses do not count toward other requirements. Grades are submitted only on the pass/fail basis. The academic deans can provide further details.

## **Submission of Term Paper**

Students who wish (under unusual circumstances) to submit a single paper for credit in more than one course must receive prior written permission from each course instructor. The student must indicate the multiple submission on the title page of the paper.

## **Declaration of Major or Division in Trinity College of Arts and Sciences**

Before declaring a major *or* interdepartmental concentration in Trinity College, students work with their premajor advisors and with other members of the faculty and staff to develop a "long-range academic plan," which outlines academic objectives and plans



for meeting goals. The plan should describe the proposed major program, related classroom and outside experiences, and the general pattern of elective courses, as well as the means by which the student will meet established college requirements for graduation. Freshmen may declare a major in the spring of the freshman year. Freshmen who elect to postpone their declaration of major will not file long-range academic plans during their first year but will be expected to discuss their progress in developing their plans with their advisors during that registration period. All students must secure formal approval of their long-range plans and must declare their major before the last day of classes in their fourth undergraduate semester. Forms for filing the official long-range plan and for registering the initial declaration of major are available in the Premajor Advising Center.

After declaring a major, students are assigned an advisor in the department of the major and an academic dean in the division of concentration. Students who, having already declared a major, wish to change their area of concentration complete a form in the Office of the Registrar and subsequently develop a revised long-range academic plan in consultation with appropriate faculty members in the new major department and, if necessary, with their academic dean. The second major should be declared in the Office of the Registrar before registering for the final term.





A student may declare an interdepartmental concentration after conferring with the Directors of Undergraduate Studies of the departments involved, and they or other advisors assist the student in preparing a program of course work. The program, which must be planned early in the undergraduate career, must consist of at least three courses beyond the introductory level in each of the departments. One of the departments should be identified as primarily responsible for the student's advising. A copy of the plan for the program, with a descriptive title which will appear on the student's permanent record, should be presented, along with the written approval of the Directors of Undergraduate Studies, to the appropriate academic dean. A student who declares an interdepartmental concentration must satisfy all other requirements for Program I.

A student may have a second major recorded on the permanent record; if the student's second major is not offered within the degree to be granted for completion of the first major, a notation of the second major will appear on the transcript. Majors offered within each degree are listed below:

*Bachelor of Arts.* Afro-American studies, anthropology, art design, art history, biology, Canadian studies, chemistry, classical studies (ancient history and archaeology), comparative area studies, computer science, drama, economics, English, French, geology, Germanic languages and literature, Greek, history, Latin, mathematics, medieval and Renaissance studies, music, philosophy, physics, political science, psychology, public policy studies, religion, Slavic languages and literature, sociology, and Spanish.

*Bachelor of Science.* Biology, chemistry, computer science, geology, mathematics, physics, and psychology.

## Changes in Status

**Withdrawal and Readmission.** Students who wish to withdraw from the college must give official notification to their academic dean. Notification must be received prior to the beginning of classes in any term or tuition will be due on a pro rata basis. (See the section on refunds in the chapter "Financial Information.") For students withdrawing on their own initiative after the beginning of classes and prior to the last four weeks of regular classes in the fall or spring term, or before the last two weeks of regular classes in a summer term, a *W* is assigned in lieu of a regular grade for each course. After these dates an *F* grade is recorded unless withdrawal is caused by an emergency beyond the control of the student, in which case a *W* is assigned by the student's academic dean.

Applications for readmission are made to the appropriate school or college. Each application is reviewed by officers of the school or college to which the student applies, and a decision is made on the basis of the applicant's previous record at Duke, evidence of increasing maturity and discipline, and the degree of success attendant upon activities during the time away from Duke. Students who are readmitted usually cannot be housed on campus.

Applications for readmission must be completed by November 1 for enrollment in the spring, by April 1 for enrollment in the summer, and by July 1 for enrollment in the fall.

**Leave of Absence.** An upperclassman in good standing may apply in writing to the appropriate academic dean to take a leave of absence for one or two semesters; the deadline for application for a leave is the end of the registration period for the semester immediately preceding the leave. Students returning from approved medical, financial, or study abroad leaves and desiring housing on campus will be placed in the general housing lottery, provided they have submitted the appropriate information to the Office of Student Affairs by the deadline noted above and provided that they lived on campus before taking their approved leave. Those students approved for personal leaves are not guaranteed on-campus housing, but will be given highest priority on the housing waiting list provided the same deadline and qualifications described above have been met. Unless an exception for an emergency is authorized by the students' academic deans, students

applying after the course registration cited above will lose their priorities in University housing for the period following the leave.

Registration materials will be mailed to a student on leave, but final registration is, of course, contingent upon the student's fulfilling the terms of the leave. A student failing to register while on leave will be withdrawn from the University and will have to apply for readmission.

A student who undertakes independent study under Duke supervision and for Duke credit is not on leave of absence even if studying elsewhere. The student registers at Duke as a nonresident student and pays the appropriate fees or tuition at Duke. This also applies to Duke programs conducted away from the Durham campus.

**Transfer between Duke University Schools.** Students in good standing may be considered for transfer from one Duke undergraduate school or college to another, upon written application and request for a letter of recommendation from their academic dean. The review of requests to transfer involves consideration of a student's general academic standing, citizenship records, and relative standing in the group of students applying for transfer. The school or college to which transfer is sought will give academic counseling to a student as soon as intention to apply for transfer is known, although no commitment will be implied.

A student may apply to transfer at any time prior to receiving a baccalaureate degree. A student transferring to Trinity College of Arts and Sciences from the School of Engineering, prior to receiving a baccalaureate degree, may not use more than six professional school credits toward the Bachelor of Arts or Bachelor of Science degree. If admitted after having earned a baccalaureate degree, a student must complete in Trinity College a total of seventeen additional courses. Transfer credit, AP credit, or courses previously used to satisfy requirements for the degree in engineering cannot be counted.

**Full-Time and Part-Time Degree Status.** Ordinarily candidates for degrees are expected to enroll for a normal course load each semester. Students who need to change from full-time to part-time status must request permission from their academic dean before the end of the preregistration period for the semester for which part-time enrollment is sought. Except for extraordinary circumstances, such permission is given only to students for the final semester of their senior year. Part-time students may register for not more than two courses (or two courses and a half-credit physical activity or dance activity course). Part-time students may not live in the residence halls.

**Resident and Nonresident status.** See the chapter "Campus Life and Activities."

**Nondegree to Degree Status.** A nondegree student must apply to the Office of Undergraduate Admissions for admission to degree candidacy.

## **Class Attendance, Excused Absences, and Tests**

Responsibility for class attendance rests with the individual student, and since regular and punctual class attendance is expected, the student must accept the consequences of failure to attend. Instructors may refer to the student's academic dean a student who is, in their opinion, absent excessively. As a rule, absences from required classes and tests are excused only for illnesses certified by a medical official of the University or for authorized representation of the University in out-of-town events. Officials in charge of groups representing the University are required to submit the names of students to be excused to the appropriate deans' offices forty-eight hours before absences are to begin.

Class times are officially scheduled at registration unless designated "to be arranged" (TBA). No class time may be changed without prior permission of the University Schedule Committee. Within-class tests (except for the final) are to be given at the regular class meeting times. Exceptions are made for block tests that have been approved by the University Schedule Committee. Hours set up for block examinations are 7:30 to 8:45 A.M. on Tuesdays and Thursdays.

## Incomplete Course Work

If because of illness, emergency, or reasonable cause a student cannot complete work for a course, the student may request in writing to his or her academic dean the assignment of an *I* (incomplete) for the course. If the request is approved by the instructor in the course and by the student's academic dean, then the student must satisfactorily complete the work prior to the last class day of the fifth week of the subsequent semester or a grade of *F* will be recorded for the course. An *I* taken in the fall semester must be resolved in the succeeding spring term; an *I* taken in the spring or summer must be completed in the following fall term. A student not enrolled in the University during that subsequent semester will have until the end of the fifth week of the next semester of matriculation to clear the *I*. An *I*, once recorded, will remain permanently on the student's record, even after the final grade is subsequently assigned for the course. If a student whose work is incomplete is also absent from the final examination, an *X* is assigned for the course. Students may not complete work in a course after graduation. For a discussion of the possible impact of an *I* grade on continuation, see the sections on satisfactory performance each term in the chapter "Degree Programs."

## Final Examinations and Excused Absences

The times and places of final examinations for the fall and spring terms are officially scheduled by the University Schedule Committee, generally according to the day and hour of the regular course meeting; changes may not be made in the schedule without the approval of the committee. If a final examination is to be given in a course, it will be given at the officially scheduled time. Take-home examinations are due at the regularly scheduled hour of an examination, based on the time period of the class. In fall or spring courses where final examinations are not scheduled, hour examinations may not be given in the last week of classes. In the summer session, final examinations are held on the last two days of each term as specified in the summer session brochure calendar. Final examinations for short courses are held on the last day of the course.

No later than the end of the first week of classes of the fall and spring term, the instructor is required to announce plans for the final examination exercise. Unless departmental policy stipulates otherwise, the form of the final exercise is determined by the instructor. However, a final written examination may not exceed three hours in length and a final take-home examination may not require more than three hours in the actual writing.

If a student is absent from a final examination, an *X* is given instead of a final grade. *An acceptable explanation for the absence must be presented to the appropriate academic dean within forty-eight hours after the scheduled time of the examination, or the X is converted to an F.* If the absence is excused by an academic dean, the student arranges with the dean and the instructor for a make-up examination to be given at the earliest possible time. An excused *X* not cleared by the end of the fifth week of the following semester is converted to an *F*. A student not enrolled in the University during that following semester has until the end of the fifth week of the next semester of enrollment to clear the *X* unless an earlier deadline has been established by the instructor and the academic dean.

## Grading and Grade Requirements

Final grades on academic work are sent to students after the examinations at the end of each term. Midterm advisory grade reports for freshmen are issued in the fall and spring.

**Passing Grades.** Passing grades are *A*, exceptional; *B*, superior; *C*, satisfactory; *P*, passing (see pass/fail option below); and *D*, low pass. These grades may be modified by a plus or minus. A *Z* may be assigned for the satisfactory completion of the first term of a two-course sequence, and the final grade for both courses is assigned at the end of the second course of the sequence.



Although the *D* grade represents low pass, in Trinity College not more than two courses passed with *D* grades may be counted among those required for year-to-year continuation or among the thirty-two courses required for graduation. Courses for which a *D* grade is earned, however, satisfy other requirements. For information on repeating a course with a *D* grade, see the section on course load and eligibility for courses in the chapter.

**Failing Grades.** A grade of *F* or *U* (see pass/fail option below) indicates that the student has failed the course. The grade is recorded on the student's record. If the student registers for the course again, a second entry of the course and the new grade earned are made on the record, but the first entry is not removed.

**Pass/Fail Option.** With the consent of the instructor and faculty advisor, a student who has declared a major may register for grading on a pass/fail basis in one elective, non-major course each term. No degree requirements, except the requirement for thirty-four course credits and the continuation requirements, may be met by a course passed under the pass/fail option, unless the course is offered only on that basis. Preceptorials, discussion sections, seminars, and tutorials may not be taken on the pass/fail basis, unless the course is offered only on that basis.

After the drop/add period in any term, no changes from pass/fail to regular status, or from regular to pass/fail status, are permitted in any course. A *P* may not be converted subsequently to a regular letter grade, and the course may not be retaken under the regular grading system.

**Grades When Absent from Final Examination.** See the section on final examination and excused absences in this chapter.

**Grades for Incompleted Work.** See the section on incompleted work in this chapter.

**WP, WF, and W Grades, and WE Designation.** *WP* and *WF* grades may be issued if a student withdraws from a course after the drop/add period. (See the sections on course changes in this chapter.) *W* grades are issued if a student withdraws from the University before the last four weeks of regular classes in the fall or spring semester, or before the last two weeks of classes in a regular summer term. (See the section on withdrawal and readmission in this chapter.)

*WE* indicates correction of an error in registration. It is not a grade.

## Academic Recognition and Honors

In determining a student's eligibility for annual recognition and graduation honors, the colleges consider only grades earned in Duke courses, including courses taken in the University's own study abroad programs and under the interinstitutional agreement.

**Annual Recognition.** In acknowledgment of high academic achievement, recognition is given each summer to freshmen, sophomores, juniors, and seniors if the following requirements are met:

1. A normal academic load has been carried in the fall and spring terms.
2. Grades other than *P* have been earned in six semester courses.
3. No incomplete or failing grade has been received during the fall and spring terms.

The *Dean's List* recognizes students who earn a 3.3 average on all work in both the fall and spring terms. The *Dean's List with Distinction* includes students who earn a 3.6 average on all work in both the fall and spring terms of an academic year.

**Graduation Recognition.** Academic excellence at graduation has been recognized at Duke at the departmental level by graduation with distinction in a disciplinary or interdisciplinary program and at the college level by Latin honors. These traditional forms of recognition continue. Beginning with students who enter Duke as freshmen in the summer or fall of 1988, a third form of recognition is available which combines features of both graduation with distinction and Latin honors—the honors program.



*Graduation with Distinction.* Academic departments and interdisciplinary programs of the colleges have programs leading to graduation with distinction. While these programs may vary in specific details, all have common basic features and all have been approved by the Honors Committee of the Undergraduate Faculty Council. To be eligible to begin a program leading to graduation with distinction, a student must show promise of achieving by the time of graduation at least a *B* average in the major field. In addition, departments may have special requirements regarding standards of performance. In the School of Engineering, for example, some departments require at least a *B* average in all subjects and may have other requirements.

Departments or interdepartmental honors committees may invite a student at the end of the sophomore or junior year to enter the Graduation with Distinction Program. The student typically participates in a seminar in the junior or senior year and/or a directed course of reading, laboratory research, or other independent study. The student must eventually present the results of individual research and study in a piece of writing judged by a departmental committee to be distinguished. The student's achievement, including the paper, is assessed by a faculty committee, and if the student has at least a *B* average in the major field, the committee may recommend that the student be graduated with distinction in the major field. A student engaged in an interdisciplinary program, including Program II, must attain an overall *B* average for courses taken in the departmental area of concentration or special study; achievement is assessed by an interdepartmental honors committee established by the Directors of Undergraduate Studies in the departments concerned. A student may also be graduated with distinction in a program of studies that does not offer a major. In such a program the student must present a *B+* grade point average in the program field and a *B* average in all subjects. The papers of students in special programs will be evaluated by a committee drawn from the faculty within those programs. Interested students should consult appropriate Directors of Undergraduate Studies or Program Directors.

*Latin Honors by Overall Academic Record.* Overall academic excellence over the entire college career traditionally has been recognized by the designations *cum laude*, *magna cum laude*, and *summa cum laude*. At Duke students who earn the following averages for approved course work are graduated with honors: 3.4, *cum laude*; 3.7, *magna cum laude*; 3.9, *summa cum laude*.

*Latin Honors by Honors Project.* Latin honors may also be awarded by Trinity College to students who successfully complete an honors project in an individual department. Honors projects must be approved by departmental faculty at successive stages during a student's junior and senior years. A candidate for Trinity College honors by honors project must have an overall grade point average of 3.3 at the beginning and end of the project to qualify for departmental nomination. Departmental procedures governing honors projects and the nomination of students for Latin honors by honors project must be approved in advance by the Honors Committee of the Undergraduate Faculty Council.

**Other Honors.** Elections to the freshman honorary society, Phi Eta Sigma, are made at the end of the fall and spring semesters. Freshmen who earn a 3.5 average in four or more semester courses in their first semester of enrollment, or those whose cumulative average at the end of their second Duke semester is 3.5 or above in a program of eight or more semester courses, are invited to membership.

Elections of undergraduate students in Trinity College and the School of Engineering to membership in the national honor society, Phi Beta Kappa, are held in the spring and fall. A review of the academic record of all prospective candidates is conducted in the junior and senior years as well as in the term following graduation. (Doctoral students, on the other hand, are nominated by their department.) Eligibility for election is determined not by the University, but by the local chapter of the society. No less than four-fifths of earned credits must have been taken on the regular grading system (*A-F*). The total number of persons elected annually is limited by bylaw to 10 percent of the graduating class. Inquiries concerning distribution requirements for students in the School of Engineer-

ing should be directed to Professor Rhett George, Department of Electrical Engineering. All other inquiries may be directed to the Secretary of Phi Beta Kappa, Box 4795, Duke Station, Durham, North Carolina 27706.

Elections to the national engineering honor society, Tau Beta Pi, are held in the fall and spring. Eligibility is determined on the basis of distinguished scholarship and exemplary character. Engineering students whose academic standing is in the upper eighth of the junior class or the upper fifth of the senior class have earned consideration by their local chapter. Inquiries may be directed to: Advisory Board, Tau Beta Pi, School of Engineering, Duke University, Durham, North Carolina 27706.

**International Fellowships.** Students interested in various prestigious fellowships for graduate study (for example, the Fulbright-Hays, Luce, Marshall, Rhodes, and Winston Churchill) should consult the academic dean in charge of fellowships, 2022 Campus Drive. Specific information about deadlines and procedures is available through that office.

## Notification of Intention to Graduate

The Diploma Card for students in Trinity College of Arts and Sciences and the School of Engineering is official notification that they expect to have completed all requirements for the degree and to receive the diploma on a particular graduation date. It is the responsibility of students to file the card on or before established deadlines. For students in Trinity College, the cards, to be filed during the fall registration period, are available in the College Recorder's office; in the School of Engineering, the Dean's office.

## Commencement

Graduation exercises are held once a year in May when degrees are conferred upon and diplomas are issued to those who have completed degree requirements by the end of the spring term. Those who complete the requirements by the end of the summer term or by the end of the fall term receive diplomas dated September 1 or December 30, respectively. There is a delay of one month to two months in the mailing of September and December diplomas because diplomas cannot be issued until they are approved by the Academic Council and the Board of Trustees.

## Prizes and Awards

The achievements of undergraduate students are recognized in various fields of activity. The following prizes suggest the range of recognition.

**The Robert E. Lee Prize.** This prize was initiated by the late Reverend A. W. Plyler, of the Class of 1892, and Mrs. Plyler and continued through the generosity of Mrs. Richard B. Maxwell, Jr., of the Class of 1942. The sum of \$50 is awarded annually at commencement to the person in the senior class of Trinity College of Arts and Sciences or the School of Engineering who, in character and conduct, scholarship, athletic achievement, and capacity for leadership, has personified most nearly the standards of the ideal student.

**Julia Dale Prize in Mathematics.** This is an annual prize of at least \$100. The winner is selected by the Department of Mathematics on the basis of excellence in mathematics. In some years first and second prizes are given.

**The Henry Schuman Music Prize.** A prize of \$350 is awarded annually to an undergraduate of Duke University for an original composition or a distinguished paper in music history or analysis. The award is sponsored by the Department of Music through a continuing gift from Dr. and Mrs. James H. Semans, who named the prize after Henry Schuman, a lifelong friend of the Semans and Trent families, a talented amateur violinist, and one who helped to build valued collections in the Duke library.

**The William Schuman Prize for Excellence in the Performance of Contemporary Music.** An annual prize of \$100 is awarded by Professor Stephen Jaffe of the Department of Music to an undergraduate who has demonstrated superior musicianship in the performance of a twentieth-century musical work (written after 1910). This prize was initiated in 1985 to honor the distinguished American composer William Schuman on his seventy-fifth birthday.

**The Edward H. Benenson Awards.** These awards of up to \$4,000 each will be given annually to undergraduates with an interest in art, music, drama, or creative writing to broaden students' educational and professional objectives. Those interested should consult the Chairman of their major department.

**The Louis Sudler Prize in the Arts.** An award is presented annually by the Institute of the Arts to a graduating senior who, in the opinion of a special institute committee, has demonstrated the most outstanding achievement in artistic performance or creation. The prize of \$1,000 was established in 1983 through the generosity of Louis C. Sudler, Chicago, Illinois. In some years first and second prizes have been given.

**The Beth Gotham Semans Drama Scholarships.** These awards are made annually to currently enrolled undergraduate students who have been and continue to be active in drama, with preference given to black and other minority students. Applicants need not be drama majors but must demonstrate significant involvement in dramatic activities. Awards range from \$1,000 to \$2,500; decisions are made by a special committee of the Institute of the Arts.

**The William M. Blackburn Scholarship.** This fund was established in 1962 to honor William Blackburn, distinguished teacher of writing at Duke. The scholarship, awarded by the Department of English, recognizes outstanding achievement in the field of creative writing.

**The Anne Flexner Memorial Award in Creative Writing.** This award has been established by the family and friends of Anne Flexner, who was graduated from Duke in 1945. There are three categories: prose fiction (5,000-word limit), poetry (200-line limit), and one-act plays (7,500-word limit). As many as three awards may be given, but no more than one in any category, for the best pieces submitted by Duke undergraduates. The amount of each award will be \$200.

**The Rudolph William Rosati Fund.** Established in 1978 by Mr. W. M. Upchurch, Jr., this fund honors the memory of his friend, the late Mr. Rosati, a talented writer. Awards are given to encourage, advance, and reward creative writing among undergraduate students. Applications for awards are made through the University Librarian.

**The Margaret Rose Knight Sanford Scholarship.** This fund was established in recognition of the untiring efforts of Margaret Rose Knight Sanford on behalf of Duke University. The scholarship provides financial assistance to a female student who demonstrates particular promise in creative writing. Awards are made by the Department of English.

**The David Taggart Clark Prize in Classical Studies.** This prize of up to \$500 derives from income earned on the generous bequest (1956) of Professor David Taggart Clark, classicist and economist. It is awarded to the senior major in Greek, Latin, or Classical Studies who is judged to have written the best honors essay of the year.

**CRC Outstanding Freshman Chemistry Award.** A copy of the Chemical Rubber Company's *Handbook of Chemistry and Physics* is awarded annually to a freshman student in general chemistry. The basis for selection by a faculty committee is academic excellence.

**American Chemical Society Undergraduate Award in Analytical Chemistry.** This prize is given annually by the Analytical Division of the American Chemical Society to an undergraduate student in analytical chemistry. The basis for selection is academic excellence and laboratory proficiency. The prize is a subscription to the journal *Analytical Chemistry* published by the American Chemical Society.

**The Phi Lambda Upsilon Prize.** Phi Lambda Upsilon, the honorary chemical society, annually awards a prize to the junior Bachelor of Science and senior Bachelor of Science majors having the highest overall academic averages. The prize is a one-year membership in the American Chemical Society. The recipients' names are inscribed on a plaque displayed in the Chemistry Library.

**North Carolina Institute of Chemists Award.** This prize is awarded annually to a graduating senior who has demonstrated a record of leadership and scholastic achievement and who has shown potential for advancement of the chemical and chemical engineering profession.

**The Chemistry Department Award.** This prize is awarded annually to an outstanding senior chemistry major in the Bachelor of Science degree program. The basis for selection is the student's independent research and interest in pursuing advanced work in chemistry. The prize is a one-year subscription to an appropriate journal.

**The Merck Index Award.** This prize is awarded annually to one or more graduating chemistry majors intending to pursue a career in medicine. Selection, by a faculty committee, is based on scholastic excellence. The prize consists of a copy of the Merck Index presented by Merck and Co., Inc.

**The James B. Rast Memorial Award in Comparative Anatomy.** The parents of James Brailsford Rast, a member of the Class of 1958 of Duke University, endowed this award in his memory. The award, consisting of the *Atlas of Descriptive Human Anatomy* by Sobotta and bearing the James B. Rast Memorial bookplate, is given annually to the student who demonstrates the greatest achievement in the study of comparative anatomy.

**The Winfred Quinton Holton Prize in Primary Education.** This prize was established in 1922 by gifts of Holland Holton, Class of 1907, and Lela Young Holton, Class of 1907, in memory of their son, Winfred Quinton Holton, with the income to be used to provide a prize for investigative work in primary education. This prize may be made annually. Competition is open to Duke seniors and graduate students who are eligible to obtain certification to teach. A student who wishes to be considered for the prize must submit a paper to be judged by a faculty committee in the Education Program.

**The William Senhauser Prize.** Given by the mother of William Senhauser in memory of her son, a member of the Class of 1942, who gave his life in the Pacific theater of war on August 4, 1944. This award is made annually to the student in Trinity College of Arts and Sciences or the School of Engineering who has made the greatest contribution to the University through participation and leadership in intramural sports. The winner of this prize is chosen by a committee appointed by the President of the University.



**The Roger Alan Opel Memorial Scholarship.** A grant is awarded annually to a Duke student who will spend a year of undergraduate study at a British university. The student is selected on the basis of intellectual curiosity, academic ability, and financial need. The award was established by the parents of Roger Alan Opel, a senior at Duke University who was killed in November, 1971.

**The William T. Laprade Prize in History.** This prize is offered in honor of William T. Laprade, who was a member of the Department of History at Trinity College and Duke University from 1909 to 1953, and Chairman of the department from 1938 to 1952. It is awarded to a senior who is being graduated with distinction and whose senior essay in history has been judged to be unusually meritorious.

**The Edward C. Horn Memorial Prize for Excellence in Zoology.** Given each year to the graduating zoology or biology major who has shown, in the opinion of the zoology faculty, the highest level of academic achievement and promise, this prize is offered in memory of Professor Edward C. Horn. It is a tribute to his warm regard for students and faculty and his appreciation of scholarly excellence. The prize consists of books appropriate to the student's field of interest.

**Alona E. Evans Prize in International Law.** An annual award to an undergraduate and/or graduate student in arts and sciences whose paper(s) on international law reflect(s) excellence in scholarship. Prizes of not more than \$250 each are derived from income earned on the generous bequest of Professor Alona E. Evans, A.B. '40, Ph.D. (political science) '45.

**Robert S. Rankin Political Science Award.** An annual award of \$100 is given to the most outstanding student in the field of American government and constitutional law. The funds are donated in memory of Professor Rankin by Judge Jerry B. Stone, A.B. '44, J.D. '48.

**Elizabeth G. Verville Political Science Award.** An annual award of \$100 derived from a gift by Elizabeth G. Verville, A.B. '61, is given for the best paper in political science submitted by an undergraduate.

**Proctor and Gamble Political Science Award.** An annual award of \$100, made possible through a grant from the Proctor and Gamble Corporation, is awarded to the graduating senior political science major who has the highest overall grade point average.

**The Karl E. Zener Award for Outstanding Performance of a Major in Psychology.** The Karl E. Zener Award is given to a psychology major who has shown outstanding performance and scholarship. The award, based on the student's total grade record and a paper submitted to the award committee, consists of a monetary prize and inclusion by name on a memorial plaque in Zener Auditorium.

**The Richard L. Predmore Award in Spanish.** Given each year to an outstanding Spanish major in honor of Richard L. Predmore, Professor of Spanish at Duke University from 1950-1978 and Dean of the Graduate School from 1962-1969.

**The Robert J. Niess Award in French.** Given each year to an outstanding French major in honor of Robert J. Niess, Professor of French at Duke University from 1972 to 1981.

**The Walter J. Seeley Scholastic Award.** This award is presented annually by the Engineers' Student Government to that member of the graduating class of the school who has achieved the highest scholastic average in all subjects, and who has shown diligence in pursuit of an engineering education. The award was initiated to honor the spirit of academic excellence and professional diligence demonstrated by the late Dean Emeritus Walter J. Seeley. It is hoped that this award will serve as a symbol of the man and the ideals for which he stood. The name of the recipient is inscribed on a plaque displayed in the Engineering Building.

**The American Society of Civil Engineers Prize.** The prize is awarded annually by the North Carolina Chapter of the American Society of Civil Engineers to two outstanding civil engineering seniors, upon recommendation of the faculty of the civil engineering department. The basis for selection is the student's scholastic record, contribution to the student chapter, and participation in other college activities and organizations. The prize consists of a certificate of award and the payment of one year's dues in the American Society of Civil Engineers.

**The George Sherrerd III Memorial Award in Electrical Engineering.** This award is presented annually to the senior in electrical engineering who, in the opinion of the electrical engineering faculty, has attained the highest level of scholastic achievement in all subjects and has rendered significant service to the School of Engineering and the University at large. The award was established in 1958 by the parents of George Sherrerd III, a graduate of the Class of 1955, to recognize outstanding undergraduate scholarship. Recipients receive a monetary award, and their names are inscribed on a plaque displayed in the Engineering Building.

**The Charles Ernest Seager Memorial Award.** This award recognizes outstanding achievement in the annual Student Prize Paper Contest of the Duke branch of the Institute of Electrical and Electronics Engineers or significant contributions to electrical engineering. The award, established in 1958 by the widow and friends of Charles Ernest Seager, a graduate of the Class of 1955, consists of inscribing the name of the contest winner on a plaque displayed in the Engineering Building.

**The Milmwow Prize.** This prize is awarded annually to students from North or South Carolina graduating in the Department of Electrical Engineering, who, in the opinion of the faculty of that department, and, as shown by their grades, have made the most progress in electrical engineering during the last year in school. The prize consists of a certificate of award and one year's payment of dues in the Institute of Electrical and Electronics Engineers for the membership year in which the honoree is awarded the baccalaureate degree.



**The Raymond C. Gaugler Award in Materials Science and Engineering.** This award is presented annually to the senior who has made the most progress at Duke in developing competence in materials science or materials engineering. The basis for selection is the student's scholastic record, research, or design projects completed at Duke, and interest in a materials-related career. The award has been established by Patricia S. Pearsall in memory of her grandfather, Raymond C. Gaugler, who was President of the American Cyanamid Company prior to his death in 1952.

**The American Society of Mechanical Engineers Award.** This award is presented annually to a senior in mechanical engineering for outstanding efforts and accomplishments in behalf of the American Society of Mechanical Engineers Student Section at Duke. The award consists of a certificate of recognition.

**The School of Engineering Student Service Award.** This award, established in 1978, is given to those graduating seniors who, by their contributions of time, effort, and spirit, have significantly benefited the community of the School of Engineering. The names of the recipients are inscribed on a plaque displayed in the Engineering Building.

**The T.C. Heyward Scholarship Award.** This award is presented annually to an outstanding senior in mechanical engineering at Duke University. The recipient is chosen by a committee of the mechanical engineering faculty and selection is based on academic excellence, engineering ability, and leadership. The recipient receives a monetary award and his or her name is inscribed on a plaque displayed in the Engineering Building.

**The William Brewster Snow Award in Environmental Engineering.** This award is presented to an outstanding senior in civil engineering who, through superior academic achievement and extracurricular activities, has demonstrated interest and commitment to environmental engineering as a career. Selection of the recipient is made by the civil engineering faculty. The recipient is presented with an inscribed plaque and his or her name is also inscribed on a plaque permanently displayed in the Engineering Building.

**The Otto Meier, Jr. Tau Beta Pi Award.** This award was established in recognition of Dr. Meier's leadership in establishing the North Carolina Gamma Chapter in 1948 and his continuous service as chapter advisor until 1975. This award is given annually to the graduating Tau Beta Pi member who symbolizes best the distinguished scholarship and exemplary character required for membership. The name of the recipient is inscribed on a plaque displayed in the Engineering Building.

**The da Vinci Award.** This award is presented by a faculty committee of the Department of Biomedical Engineering to the biomedical engineering senior with the most outstanding academic record. This award commemorates the contributions of Leonardo da Vinci in laying the foundations for the study of biomechanics.

**The von Helmholtz Award.** This award is presented by a faculty committee of the Department of Biomedical Engineering to the biomedical engineering senior who has made the most outstanding contribution to the department. This award commemorates the work of von Helmholtz in laying the foundations of biomedical engineering.

**Aubrey E. Palmer Award.** This award, established in 1980, is presented annually by the faculty of the Department of Civil and Environmental Engineering to a civil engineering senior in recognition of outstanding academic achievement. The award consists of a certificate of recognition and the name of the recipient inscribed on a plaque displayed in the Engineering Building.

**The Mechanical Engineering and Materials Science Faculty Award.** This award is presented annually in recognition of academic excellence to the graduating mechanical engineering senior who has attained the highest level of scholastic achievement in all subjects. The name of the recipient is inscribed on a plaque displayed in the Engineering Building.

## Education Records

Duke University adheres to a policy permitting students access to their education records and certain confidential financial information. Students may request review of any information which is contained in their education records and may, using appropriate procedures, challenge the content of these records. An explanation of the complete policy on education records may be obtained from the Registrar's office.

No information, except directory information (see below), contained in any student records is released to persons outside the University or to unauthorized persons on the campus, without the written consent of the student. It is the responsibility of the student to provide the Office of the Registrar and other University offices, as appropriate, with the necessary specific authorization and consent.

Directory information includes name, addresses, telephone listing, photograph, major field of study, participation in officially recognized activities and sports, weight and height of members of athletic teams, dates of attendance, degrees and awards received, and most recent previous educational institution attended. This information may be released to appear in public documents and may otherwise be disclosed without student consent unless a written request not to release this information is filed in the Office of the Registrar by the end of the first week of classes each term.

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*Special Study Centers, Programs,  
and Opportunities*



## Campus Centers and Institutes

### CENTER FOR INTERNATIONAL STUDIES

The University's Center for International Studies coordinates and supports a wide array of research and teaching activities on international issues in Arts and Sciences and the professional schools. Faculty associated with the center come from diverse disciplines and reflect a wide range of intellectual interests. Their primary bond is a concern with peoples, events, movements, and institutions outside the United States; relations among nations; and activities and institutions in the United States that affect the rest of the world. These faculty share the belief that many, if not most, matters of importance occurring within the United States have significant effects abroad and that important activities that take place abroad frequently affect this country. They agree that the awareness of relationships among peoples, events, cultures, movements, institutions, and processes are essential for an appreciation of the world in which we live and deserve primary emphasis in teaching and research in the University.

The functions of the center are to provide focus, structure, and support to the research efforts of associated scholars and to serve as a catalyst for the coordination of varied research undertakings. It also assists in dissemination of these undertakings and fosters international activities in educational, research, and governmental institutions in the southeastern United States.

The Center for International Studies is involved in monitoring and initiating change in the international curricula of the undergraduate, graduate, and professional schools of the University. It has a special interest in undergraduate education and, through a variety of programs and activities, makes a contribution to the undergraduate academic experience. It seeks to attract students to the wide range of international and comparative courses available and administers the major of the Program in Comparative Area Studies, where students can concentrate on Africa, East Asia, the Caribbean, Latin America, the Middle East, Russia and Eastern Europe, South Asia, Canada, or Western Europe. (See the chapter "Courses of Instruction.") All students are encouraged to pursue study abroad opportunities as well as language study in non-Western and Western languages.

The center also works toward establishing a closer relationship between foreign students and those interested in international studies (see the section on International House in the chapter "Campus Life and Activities").



Area studies function in centers, institutes, or programs in the following areas:

**African Studies.** This program brings together faculty with a common interest in problems of the African continent. It encourages course work and lectures in African studies. Associated faculty work closely with students concentrating on Africa in the major in comparative area studies.

**Asian/Pacific Studies.** This program, administered by the Asian/Pacific Studies Institute, supports and encourages Asian and Pacific studies with special emphasis on Japan and China. Courses offered cover a range of disciplines including Japanese, Chinese, Korean, anthropology, economics, art, history, political science, music, and religion. The institute provides support for visiting lecturers and conferences and makes available a limited number of fellowships annually. Study abroad opportunities are available in China and Japan. An East Asia concentration is possible for majors in comparative area studies.

**Canadian Studies.** The Canadian Studies Center administers the Canadian Studies Program, which offers courses introducing students to various aspects of Canadian life and culture. Courses and lectures in a wide range of disciplines in the humanities and the social sciences are designed to increase students' knowledge and understanding of Canada. Special emphasis is placed on Canadian problems and comparisons of Canadian and American perspectives. Concentrations in Canadian studies are described in the chapter "Courses of Instruction." Study abroad opportunities are available.

**South Asian Studies.** The South Asian Program combines scholars from Arts and Sciences and the professional schools whose research deals with the societies and cultures of the Indian subcontinent. The program offers courses in Hindi-Urdu, an introductory course on the civilizations of the Indian subcontinent, and topical courses presenting a wide-ranging view of the past and present of the Indian subcontinent. Majors in comparative area studies may elect a South Asian concentration. The program also helps sponsor cultural events put on by the Duke University South Asian Students Association.

**Islamic and Arabian Development Studies.** The Center for Islamic and Arabian Development Studies, established in 1977 and assisted by grants from the government of Saudi Arabia and American corporations, administers this program. Students majoring in comparative area studies can concentrate in the Middle East, choosing from courses in Arabic, anthropology, history, literature, political science, and religion. The center provides financial support for outside lecturers in an interdisciplinary Islamic civilization course, a survey course on contemporary Arab affairs, and a senior-graduate seminar in comparative development problems in the Islamic world. The center also presents an outreach program to colleges and universities in the Southeast, conducts international conferences, supports lecturers, and has offered a summer program for college teachers.

**Latin American Studies.** The Council on Latin American Studies administers a comprehensive program in Latin American studies. A wide range of courses in the humanities, the social sciences, Portuguese, and Spanish is offered. Visiting professors and lecturers from Latin America, a speakers series, conferences, and summer programs abroad are supported by the program. Faculty associated with the program work closely with students majoring in comparative area studies who concentrate in Latin America.

**Caribbean Studies.** The Caribbean studies committee focuses its activities on the problems and issues common to the various societies in this culturally diverse region. The committee views the Caribbean region as an ideal laboratory for analysis of issues such as colonialism, race relations, and development problems. The program works closely with the Council on Latin American Studies to serve the needs of students with an interest in this area.

**Western Europe and the Advanced Industrial Democracies.** This program combines the talents of experts in Western Europe, Japan, and North America in studies investigating



problems common to advanced industrial societies. Faculty associated with the program work closely with students concentrating in Western Europe in the major in comparative area studies.

**Russian and East European Studies.** This program concentrates on Eastern Europe. It encourages proficiency in the Russian language. The faculty work closely with students concentrating on Russia in the major in comparative area studies.

*In addition, the center promotes interdisciplinary research and teaching around thematic issues. These thematic interdisciplinary committees in 1988-89 include:*

**International Advertising and Communications.** This program focuses attention through its lecture series and the courses offered under its auspices on the relation between advertising and society in both advanced industrial nations and the developing countries of the world.

**Comparative Labor Studies.** This committee brings together historians, sociologists, political scientists, and other faculty members at Duke with interests in labor and the working class. The committee in particular promotes scholarship and teaching dealing with the comparative study and history of labor in different nations.

**Gender in International Perspective.** This program explores comparative aspects of gender research in countries of the North and the South.

Additional information on international studies and the Program in Comparative Area Studies is available from the Center for International Studies, 2122 Campus Drive, Durham, North Carolina 27706.

#### **CENTER FOR RESEARCH ON WOMEN (Duke-UNC Chapel Hill)**

The Duke-UNC Center for Research on Women was founded in 1982 as a collaborative endeavor between Duke University and the University of North Carolina (Chapel Hill) to promote women's studies scholarship and research throughout the tri-state area of North Carolina, South Carolina, and Virginia; to support curriculum development in women's studies; and to disseminate women's studies research and information throughout the South. The center principally seeks to explore the intersection of gender, race, and class, with a particular emphasis on the American South and Third World societies.

Its regular activities include a lectureship series, a working paper series, publications, and the sponsorship of conferences, colloquia, and community events. Students seeking information should inquire at 207 East Duke Building (Duke), (919) 684-6641 or at 03 Caldwell Hall 009A (University of North Carolina, Chapel Hill), (919) 966-5787.

#### **CONTINUING EDUCATION**

**Academic Study.** Local adult residents are encouraged to pursue academic study at Duke (1) as provisional degree candidates, for those resuming or beginning a bachelor's degree; (2) as nondegree students, for those seeking a sequence of undergraduate credit courses; and (3) as students completing the last year of work towards a degree at another institution. These students are given academic and career counseling by the Office of Continuing Education. They are subject to most of the regulations set forth for degree candidates. Continuing education applications may be obtained from the Office of Undergraduate Admissions and must be returned to that office, accompanied by a \$35 application fee, by August 1 for the fall semester and by December 1 for the spring semester.

**Career Development Services.** Career Development Services assists persons making decisions about returning to work, re-entering school, career planning and assessment, life/work transitions, and individual goal setting. Individual appointments, group sessions, and workshops are held.

**Short Courses and Conferences.** Short courses (noncredit) in the liberal arts are offered regularly throughout the year for those interested in personal enrichment or career advancement. Conferences, institutes, and training programs are conducted during the academic year and in the summer. Some are residential and others are designed for local participants. Some award continuing education units.

**The Institute for Learning in Retirement.** The institute is for persons over fifty years of age who recognize in themselves a need to continue learning and sharing knowledge.

For brochures on each program and for fuller information, write or call the Office of Continuing Education, The Bishop's House, East Campus, (919) 684-6259.

## **INSTITUTE OF THE ARTS**

The Institute of the Arts creates and maintains interdisciplinary approaches to understanding and participating in the arts within the curricular and extracurricular frameworks of Duke University. To accomplish this mission, the institute administers an interdisciplinary arts curriculum, manages a university-wide artist residency program, and promotes multifaceted arts programming. A certificate program in the arts is offered by the institute as well as a one-semester, off-campus residency program, Duke in New York Arts. The institute is also the administrative home for the Duke Dance Program. The institute is committed to defining a broader role for the professional artist as a resource for the University and surrounding community, through the Nancy Hanks Artist Residency Program. Prominent artists are brought to campus to participate in classes, give workshops, perform and create, and work with students individually and in groups. Throughout the year the institute sponsors events, festivals, and symposia designed to enrich campus and community life. For further information, inquiries should be made to Duke University Institute of the Arts, 109 Bivins Building, (919) 684-6654.

## **INSTITUTE OF STATISTICS AND DECISION SCIENCES**

The Institute of Statistics and Decision Sciences was founded in 1985 to conduct and coordinate teaching and research in statistics and the application of quantitative methods to the study of decision making. The institute offers training and consultation in mathematical statistics, statistical modelling, applied statistics, statistical computing, operations research, game theory, decision analysis, and utility theory. Students interested in the activities of the institute should consult the institute office, 322 Old Chemistry Building, (919) 684-4210.

## **Programs Not Offering Majors**

Through the programs described below, students have the opportunity to engage in the concentrated study of an area not offering a major. These programs, supplements to the basic course of study, usually reach beyond departmental boundaries and generally provide an interdisciplinary focus to the subject matter. If completed, many offer official recognition of participation, often in the form of a certificate. More information may be obtained from the directors of the programs.

## **FILM AND VIDEO**

The Program in Film and Video introduces students to the critical analysis of new communications technologies: film, photography, and television. Practical experience in 16mm film and videotape production is also available through course work and internships. Established in 1986, this program also sponsors speakers, film and television screenings, and exhibits in cooperation with the Center for Documentary Photography, the Institute of the Arts, and the Center for International Studies. For further information, students should consult the program director, 319 Carr Building.

## HUMAN DEVELOPMENT

This interdisciplinary program provides opportunities to compare and to explore the complementarity of disciplinary perspectives on the biological, biomedical, psychological, social, and cultural aspects of human development. The program, which is more fully described under "Courses of Instruction," integrates courses, a research apprenticeship, and special events through an active advisory procedure. For more information and a program brochure, inquire at the University Council on Aging and Human Development, 1512 Busse Gerontology Building, (919) 684-6118.

## JUDAIC STUDIES

Duke University through the auspices of the Center for Judaic Studies offers a full range of courses in Judaic civilization. Participating departments and programs include religion, Germanic languages, comparative literature, political science, international studies, anthropology, and women's studies. Also, courses may be taken at nearby Chapel Hill where additional courses are offered under the rubric of the Joint Program in Judaic Studies. A full range of courses is available in classical and modern Hebrew as well as in Yiddish. Students desirous of further language training or specialization may elect to pursue their studies in Israel during their junior year at a Duke approved program.

The program in Judaic studies is largely focused on undergraduates who may earn a certificate in Judaic studies after taking any four nonlanguage courses, or who may pursue Judaic studies under Program II, the alternative program option. This option offers a student the flexibility to design, with the aid of a faculty advisor, a curriculum to accommodate unusual interests and talents. Some students may also choose to concentrate on Judaic studies within the context of a religion major; such students are also eligible to receive a certificate.

Duke regularly sponsors its own summer program in Israel and over 700 students have participated in it to date. For further information, inquire at the Center for Judaic Studies, P.O. Box 4735, Duke Station, Duke University, Durham, North Carolina 27706.

## NEUROSCIENCES

The neurosciences program reflects the rapid developments in our understanding of brain mechanisms and behavior. Undergraduates are offered opportunities to learn about these developments in new and existing courses. The approach to the neurosciences is broad, covering the cellular and subcellular levels (molecular and genetic properties, cell and membrane physiology, neurochemistry), systemic levels (neuroanatomy, sensory and reflex function, brain disorders), and integrative levels (perception, memory, behavioral genetics, evolution of brain and behavior). The program emphasizes breadth in the arts, sciences and humanities, with an understanding of the neurosciences as an integral part of a liberal education. For further information, consult the director, Professor John Staddon, 250 Psychology-Sociology Building.

## PERSPECTIVES ON MARXISM AND SOCIETY

Perspectives on Marxism and Society is a program devoted to the study of Marxist theories of society. Courses in the program focus on Marxism, not primarily as a political or ideological system, but as a scholarly methodology incorporating a variety of analytical techniques across a wide range of disciplines. The unifying theme of the program is a critical appraisal of Marxist methods of analysis and their social implications, considered in the light of theoretical alternatives and changing historical circumstances. Courses included in the program cover a wide range of subjects, including sexual and racial inequality, alienation, development and underdevelopment in the world system, labor processes, protest movements, and ideologies.

Students in the program will be required to take a core course in varieties of Marxist analysis. Four more approved courses, no more than three from one department, will



complete the program of study. A certificate will be awarded to those who meet the requirements of the program. Students in the program will be expected to major in another discipline, with the program a supplement to their major. Full details concerning the program and its courses can be obtained by writing or calling the director, Professor Fredric R. Jameson, Graduate Program in Literature and Duke Center for Critical Theory, 302 Carr Building, 684-4127.

### **PRIMATOLOGY**

The primate program provides an interdisciplinary investigation of primate development and evolution from the anatomical, ecological, and behavioral perspectives. Theoretical issues arising from sociobiology and new fossil discoveries will be tested as to their validity when applied to human evolution. The course of study leads from a generalized introduction through more specialized topics to the design and completion of a research project under the guidance of a faculty member. The final step is an oral presentation of the research results in a senior seminar. For more information on the Primatology Program call the Department of Biological Anthropology and Anatomy at 114 Social Sciences Building, (919) 684-5012.

### **SCIENCE, TECHNOLOGY, AND HUMAN VALUES**

The Program in Science, Technology, and Human Values provides students an opportunity to explore the social and cultural dimensions of science, technology, and medicine. Through course work and a wide variety of extracurricular activities, students are introduced to the perspectives and insights of other disciplines in order to develop a richer and more informed understanding of their own field of specialization. The program brings together students and faculty from the sciences and engineering with their counterparts in the humanities and social sciences, with a heavy emphasis on interdisciplinary study and discussion. Detailed information is given in the chapter "Courses of Instruction" in the Bulletin.

### **TWENTIETH-CENTURY AMERICA PROGRAM**

The Twentieth-Century America Program explores modern American society in a group of interrelated courses from the perspectives of history, literature, sociology, religion, and political thought. The program offers five courses in the fall, of which participants must take at least three. Some forty-five students are selected for the program; all undergraduates may apply.

This special program provides the student with the opportunities that come from relatively small classes (often of seminar format), a program of interrelated and mutually reinforcing courses, and close relationships with professors and stimulating fellow students.

Courses that the program has offered include University Writing Course (special section), History 92, Sociology 101, Political Science 144S, and Religion 60S (see descriptions in this bulletin). Further information and application forms may be obtained from the director of the program who can be reached through the Premajor Advising Center.

### **WOMEN'S STUDIES**

The Women's Studies Program is a multidisciplinary forum for the study of women's roles and gender differences in various societies, past and present. Established in 1982, it offers courses, lectures, films, programs, and research support and brings together faculty and students from all fields who are concerned with both the theoretical questions stemming from the study of gender in the disciplines as well as the implications of such investigations for women and men in contemporary societies. The program seeks to encourage the use of new scholarship, which in the last two decades has challenged empirical and theoretical understandings of the sexes, from the perspectives of the humanities, the social sciences, and the biological sciences. *Signs: Journal of Women in Culture and Society* is edited in the Office of Women's Studies, providing students with the opportunity to be involved in the development of the most recent scholarship on



women. For more information on Women's Studies, inquire at the Office of Women's Studies at 207 East Duke Building, (919) 684-5683.

## RESERVE OFFICER TRAINING CORPS

Duke University and the military services cooperate in offering officer education programs to provide opportunities for students to earn a commission in the United States Air Force, Army, Navy, or Marine Corps. The programs are described below, and detailed information on scholarships, entrance requirements, and commissioning requirements is available from the offices of the Department of Air Force Aerospace Studies, the Department of Military Science (Army), and the Department of Naval Science. Courses offered in these departments are described in the chapter "Courses of Instruction" in this bulletin.

**The Air Force Reserve Officer Training Corps (AFROTC).** AFROTC selects, trains, and commissions college men and women to serve as officers in the U.S. Air Force. Two AFROTC programs are available, a four-year and a two-year program.

The four-year program consists of the General Military Course (GMC) taken during the freshman and sophomore years and the Professional Officer Course (POC) taken during the junior and senior years. Entry into the GMC is open to all freshmen and sophomores. Entry into the POC is competitive and requires successful completion of a four-week field-training encampment at a selected Air Force base during the summer between the sophomore and junior years.

Students interested in the two-year program should submit applications no later than early spring semester of their sophomore year. Entry into the two-year program is competitive and requires the successful completion of a six-week summer field-training encampment prior to entry.

Cadets may compete for three and one-half-, three-, two and one-half-, and two-year scholarships. All scholarship and POC cadets receive a tax-free stipend of \$100 per month. On graduation, cadets are commissioned as second lieutenants in the Air Force Reserve and are obligated to serve four years of active duty. Direct inquiries to the Department of Aerospace Studies, 304 North Building, (919) 684-3641.

**The Army Reserve Officers' Training Corps (AROTC).** Army ROTC provides students with an opportunity to earn a commission as a second lieutenant in the U.S. Army, U.S. Army Reserve, or Army National Guard while completing requirements for a baccalaureate degree. Two programs are available, a four-year and a two-year program.

The four-year program consists of the Basic Course (freshman and sophomore years) and the Advanced Course (junior and senior years). Direct entry into the Advanced Course is possible under specific circumstances (two-year program). Students wishing to join the two-year program must confer with the Department of Military Science not later than April 1 of their sophomore year. There is only one mandatory summer training requirement, Advanced Camp, which takes place over a six-week period between the junior and senior years. All uniforms and AROTC texts are provided.

Upon commissioning, the service obligation may be served on active duty, in the Army Reserve, or in the Army National Guard, as directed by the Secretary of the Army. At the beginning of the senior year, cadets submit a preference statement concerning the method by which they wish to fulfill their service obligation and the specialty in which they desire to serve. A request to delay the fulfillment of the service obligation in order to attend graduate or professional schooling is also authorized.

Cadets are encouraged to compete for Army ROTC scholarships which pay 80 percent tuition, most fees, a generous textbook and equipment allowance, and \$100 per month for each month in school (up to \$1,000 per year). Nonscholarship Advanced Course cadets also receive the \$100 monthly stipend. All of the above benefits are tax-free. Participants in Advanced Camp are paid one-half of the basic pay of a second lieutenant.

Detailed information is available from the Department of Military Science, 06 West Duke Building, East Campus, (919) 684-5895, or 1-800-222-9184.

**The Naval Reserve Officer Training Corps (NROTC).** The Department of Naval Science offers students the opportunity to become Naval and Marine officers upon graduation. Selected students may receive up to four years of tuition, fees, uniforms, and textbooks at government expense under the auspices of the Scholarship Program. In addition, scholarship students receive subsistence pay and summer active duty pay of approximately \$1,300 a year. They participate in four weeks of summer training either aboard ship or at naval shore facilities to augment their academic studies. Four years of active duty service as a Regular Officer is required upon graduation.

Nonscholarship students may be enrolled in the College Program. They take the same courses and wear the same uniform, but attend the University at their own expense. Uniforms and naval science textbooks are provided by the government. During the last two academic years, they are enlisted in the Naval Reserve, receive \$100 per month subsistence pay, and participate in summer training. Three years active duty service as a Reserve Officer is required upon graduation.

College Program students may compete for scholarship status through academic performance, demonstrated aptitude for military service, and nomination by the Professor of Naval Science. Students in either program may qualify for a commission in the Marine Corps through the Marine Corps Option Program. Students seeking further information on the NROTC program may call the Department of Naval Science, Hanes House, (919) 684-3841.

## Off Campus Opportunities

### STUDY ABROAD

A Duke student may earn credit for approved work completed during the academic year at a foreign university or for an approved program abroad sponsored by Duke or by another approved American college or university in the fall, spring, and summer. To receive the maximum amount of study abroad transfer credit at Duke—four course credits for a full semester, eight for a full academic year, two for a summer—a student is expected to take a full, normal course load, as defined by the other institution involved. No additional study abroad transfer credit will be awarded for a course overload. A leave of absence from the University is granted for a semester or academic year of approved study abroad. Duke-administered programs do not involve transfer credit and do not require a leave of absence. Arrangements are made normally for students to register, while abroad, for the term in which they plan to return. Seniors planning to spend their last semester abroad are subject to the residence requirement and may face postponed graduation because transcripts from abroad are often delayed.

### Semester and Academic Year Programs

A student who wishes to receive transfer credit for study abroad should take into account the following criteria established by the faculty and administered by the Committee on Study Abroad:

1. a scholastic average of at least a *B-* (a student lacking this average may petition the academic dean responsible for study abroad if there are unusual circumstances);
2. certification, when applicable, from the foreign language department concerned, that the student has an adequate knowledge of the language of the country in which study is pursued;
3. approval, obtained before leaving Duke, of the appropriate Directors of Undergraduate Studies for the courses to be taken abroad, as well as approval of the program and the courses by the dean responsible for study abroad and by the student's academic dean;
4. permission for leave of absence once program plans are complete.

Duke, at present, offers various programs in cooperation with other universities during the fall and spring terms. Students accepted may study in:

*Austria.* From time to time Duke sponsors a term program in Vienna for members of the Wind Symphony and other interested students. More information is available from Professor Paul Bryan, Department of Music.

*Britain.* Duke has agreements with a number of top British universities, allowing our students to become members of outstanding teaching and research institutions in Britain for a semester or academic year. The universities currently available are King's College (University of London), London School of Economics (University of London), University of Manchester, University of Sussex, University College London (University of London), and Warwick University. There is a special program for civil engineers at University College London. Applications are available at 2022 Campus Drive.

*Canada, Montreal.* Duke students participating in the Duke/McGill University Exchange Program may spend one semester or academic year at McGill, located in the Quebec city of Montreal. Because the language of instruction at McGill is English, program applicants need not have studied French although some knowledge of it would be advantageous. The program is sponsored by the Canadian Studies Center and Trinity College; information and application forms are available at 2022 Campus Drive.

*China.* In cooperation with Nanjing University and Beijing Teachers College, Duke conducts a six-month study program in the People's Republic of China in the summer and fall terms. The program includes a fall term at Nanjing University preceded by an intensive language session in Peking. Participants must have at least one year of Chinese language. Information is available from the Asian-Pacific Studies Institute, 2111 Campus Drive, and at 2022 Campus Drive.

*Egypt, Cairo.* Through an agreement with the American University in Cairo, Duke students may spend a spring semester or academic year there taking regular classes with Egyptian students. They may enroll in general courses in humanities, social sciences, and sciences, as well as in Arabic language and specialized courses in Middle Eastern studies. Applications are available at 2022 Campus Drive.

*England, Oxford.* Through a special arrangement with several colleges at the University of Oxford, selected Duke students may spend their junior year at Oxford as regularly enrolled visiting students. The students are treated exactly like their British counterparts, and most of them live in college housing. Students may choose to concentrate their study in any one of the major fields in the humanities, social sciences, or selected natural sciences. Each student is assigned a tutor. Applicants must have a very strong academic record; previous course work in the subject to be pursued at Oxford is also required. More information may be obtained from 2022 Campus Drive.

*France, Paris.* Duke offers a full-year program in Paris in conjunction with the University of Paris-VII in the heart of the Latin Quarter. The language of instruction will be French; one course will be offered by the Resident Director from Duke, and three courses will be taught by the faculty of Paris-VII. Applicants must have completed four semesters of French plus two courses at the 100-level or above with a grade of at least *B+*. Priority will be given to juniors and full-year applicants, although some participants may be admitted for one semester only. More information may be obtained from 2022 Campus Drive or the Department of Romance Studies, 205 Languages Building.

*Germany, West Berlin.* Each spring and summer (mid-February–mid-July) Duke offers a special study program at the Free University of West Berlin for students in junior, senior, or post-baccalaureate standing and with an advanced knowledge of German. Students are matriculated as regular students of the Free University and enroll in two intensive German language courses on the advanced level and one special course each in German history and political science, and will earn four regular Duke credits. In addition they audit at least one regular Free University course of their choice. More complete information may be obtained in the Office of the Summer Session, 121 Allen Building.



*India, Madras.* Duke students may participate in a fall semester program administered by the consortium of the South Atlantic States Association for Asian and African Studies, of which Duke is a member. The program, which is offered in alternate years, offers courses in Indian history and culture, beginning Tamil, and independent research. More information may be obtained at 2022 Campus Drive.

*Italy, Rome.* As one of the participating members of the Intercollegiate Center for Classical Studies in Rome, Duke University may send classics majors and other students with strong classical interests for admission to a term's work at the center, usually in the junior year. Instruction is offered in Greek, Latin, ancient history, ancient art, and archaeology. Some scholarship help is available. Additional information may be obtained from the Department of Classical Studies, 328 Carr Building.

*Japan, Tokyo.* Qualified students may be recommended each year by the Asian-Pacific Studies Committee for the junior year exchange program with International Christian University in Tokyo. This small, select university is noted for the international character of its student body (85-90 percent Japanese, 10-15 percent non-Japanese, primarily from other Asian nations and the United States). Courses may be taken in English as well as Japanese. More information is available from the Asian-Pacific Studies Institute, 2111 Campus Drive, and 2022 Campus Drive.

*Scotland, Glasgow.* The Department of Public Policy Studies offers departmental majors the opportunity to study during the fall semester of their senior year at the University of Glasgow, where, practically speaking, public policy analysis was invented. Students will live on campus and will take the program's special seminar in public policy, in addition to three electives from the general university curriculum. Further information may be obtained from the Director of Undergraduate Studies in the Department of Public Policy Studies, 116D Old Chemistry Building.

*Spain.* This program offers advanced students a variety of on-site experiences and an opportunity to hear and speak Spanish in an ideal environment. The program offers courses in Spanish history, culture, literature, politics, and arts, as well as several organized excursions. Students are housed with selected Spanish families. More information may be obtained from Professor Miguel Garci-Gómez, Department of Romance Studies.

Further information concerning semester and academic year programs, as well as the Oxford Summer Program (described below) and non-Duke summer programs, may be obtained at 2022 Campus Drive. All Trinity College students are responsible for following the procedures and meeting the deadlines set forth in Duke's study abroad booklet, *Opportunities for Undergraduate Study Abroad*, available there. In all cases, the dean of study abroad must be informed in advance about a student's plans.

## Duke Summer Programs Abroad

The Office of the Summer Session, in cooperation with several University departments, provides many opportunities for students to study abroad while earning Duke University credit. Information about Duke Summer Programs Abroad and about the time they will next be offered can be obtained from the program directors or the Office of the Summer Session, 121 Allen Building.

*British Isles, England, Cambridge.* The Summer Session Office and the Department of Political Science offer a two-course, six-week program at the University of Cambridge focusing on the comparison of the British and American legal systems. One course is taught by Professor Paul Haagen of Duke, the other by faculty members of the University of Cambridge. Students live at Emmanuel College, Cambridge University. For further information see Professor Paul Haagen, School of Law, 017 Law School.

*British Isles, England, Durham.* The Summer Session Office and the Departments of Religion and English offer a two-course, six-week program at the University of Durham on English fiction from the 1830s to the 1980s and its relation to religion. One course is taught by Professor Wesley Kort of Duke, the other by a faculty member of the University

of Durham. Students live in one of the university's colleges. For further information see Professor Wesley Kort, Department of Religion, 328 Gray Building.

*British Isles, England, London.* The Summer Session Office, Duke Drama, and the Department of English offer a two-course, six-week program in London, focusing on the history and analysis of theater in Britain with study of dramatic texts and their production. One course is taught by Professor John Clum of Duke's Drama Program and Department of English, the other by a faculty member of the Department of Drama and Theatre Studies of the University of London. Students live in dormitories. For further information see Professor John Clum, Department of English, 304B Allen Building.

*British Isles, England, Oxford.* The Duke/Oxford Summer Program, a six-week session at New College, Oxford, utilizes the Oxford tutorial system of education. The tutorial format is supplemented by the lectures given at the University of Oxford International Graduate Summer School by noted British scholars. Detailed information may be obtained in the Study Abroad Office, 2022 Campus Drive.

*British Isles, Ireland, Scotland, England.* The Summer Session Office and the Department of Religion offer a two-course program on ethical issues in health and illness in the United States, Ireland, and Great Britain. Lectures by medical personnel are supplemented by site visits to medical facilities and health care agencies. The first two weeks of study are in Dublin, the next three weeks in Edinburgh, and the last week in London. Students live in dormitories. For further information see Professor Thomas McCollough, Department of Religion, 325 Gray Building.

*Canada.* The Summer Session Office, the Department of History, and the Canadian Studies Program offer a two-course, six-week program based at McGill University in Montreal. Included in the program is an extensive study trip throughout Canada. The objectives of this program are to familiarize students with the historical, political, and social reality of Canada as a bilingual and bicultural society. Students live in dormitories and hotels. For further information see Professor Clark Cahow, Canadian Studies Center, 2016 Campus Drive.

*The Caribbean.* The Summer Session Office and the Departments of History and Political Science offer a two-course, six-week program in Trinidad and Tobago. The program focuses on colonial history and culture, and on government and politics of the West Indies. One course is taught by Professor Barry Gaspar of Duke. The other course is taught by a faculty member of the University of the West Indies at the St. Augustine campus in Trinidad. Students live in a hotel. For further information see Professor Barry Gaspar, Department of History, 08C West Duke Building.

*France.* The Summer Session Office and the Department of Romance Studies offer a two-course, six-week program in Paris. It provides the opportunity to take Duke courses in the ambience of Paris. One course is in French language; the other is in French literature and culture. Both courses are taught in French. Students live in a hotel. For further information see Professor Clare Tufts, Department of Romance Studies, 205 Languages Building.

*Germany.* The Summer Session Office and the Department of Germanic Languages offer two programs at the Friedrich-Alexander Universität at Erlangen, Germany. One program provides an opportunity to study classroom German at different levels while living with a German family and participating in study, day trips, and excursions (May and June). In the other program, advanced students may choose from a variety of FAU courses and remain for a full summer semester (through early August). Semester program students live in dormitories. For further information see Professor Helga Bessent, Department of Germanic Languages, 107 Languages Building.

*Greece.* The Summer Session Office and the Department of Classical Studies offer a one-course, four-week program in Greece featuring readings, walking lectures, and touring important sites and museums to study the development of the preclassical, classical, Roman, and Byzantine cultures in Greece. The course is taught by Professor John

Younger of Duke. Students live in hotels. For further information see Professor John Younger, Department of Classical Studies, 316 Carr Building.

*Israel.* The Summer Session Office, the Department of Religion, and the Duke Center for Judaic Studies offer a summer program in Israel—in Jerusalem and Galilee—giving students an opportunity to participate in an archaeological dig and to explore historical and contemporary Israel, as well as Western religious traditions. Students live in dormitory-style accommodations. For further information see Professors Carol Meyers or Eric Meyers, Department of Religion, 118 Gray Building.

*Italy, Bologna.* The Summer Session Office and the Departments of Romance Studies and Political Science offer a two-course, six-week program at the University of Bologna in Italian politics and culture. One course is taught by Professor Valeria Finucci of Duke, the other by a member of the faculty of the University of Bologna. Both courses are taught in English. Students live in a hotel. For further information see Professor Valeria Finucci, Department of Romance Studies, 310 Languages Building.

*Italy, Florence.* The Summer Session Office, the Department of History, and the Department of Art and Art History offer a two-course, six-week program focusing on Renaissance Florentine history and art. Both courses are taught in English. Students live in a hotel. For further information see Professor John Spencer, Department of Art and Art History, 112 East Duke Building.

*Italy, Rome.* The Summer Session Office, the Department of Classical Studies, and the Department of Art and Art History offer a two-course, six-week program in Rome and central Italy. Through visits to sites and museums, walking lectures, and readings, the courses examine the history of the city of Rome from the earliest times through the Baroque and modern periods. Students live in dormitory-style accommodations. For further information inquire at the Summer Session Office, 121 Allen Building.

*Japan.* The Summer Session Office, the Department of History, the Department of Sociology, and the Institute of Asian/Pacific Studies offer a two-course, six-week program at Hosei University near Tokyo focusing on Japanese history and culture. One course is taught by Professor Andrew Gordon of Duke, the other by faculty of Hosei University. Both courses are taught in English. Students live variously in dormitories and with families. For further information see Professor Andrew Gordon, Department of History, 104 West Duke Building.

*Mexico.* The Summer Session Office, the Department of Sociology, and the Department of Political Science offer a two-course, six-week program on Mexican politics and international relations and the problems encountered by a developing country. The program is based at the Colegio de México in Mexico City under the direction of Professor Gary Gereffi of Duke. Both courses are taught in English by Duke faculty and faculty of the Colegio de México. Students live in dormitory-style facilities. For further information see Professor Gary Gereffi, Department of Sociology, 268 Sociology-Psychology Building.

*Morocco.* The Summer Session Office, the Institute of Asian-Pacific Studies, and various other departments offer a program at the University of Marrakesh. The course offerings vary from year to year. Courses are taught in English. Students live in hotels. For further information see Professor Miriam Cooke, Institute of Asian-Pacific Studies or inquire at the Summer Session Office, 121 Allen Building.

*The Netherlands, Amsterdam, Learning Disabilities.* The Summer Session Office and the Program in Education, in conjunction with the Department of Psychology, offer a two-course, six-week program in Amsterdam on learning disabilities with Professor Lucy Davis of Duke and Professor Dr. Jacob Valk, Department of Neuroradiology of the Free University of Amsterdam. The program is taught in English and is designed primarily for advanced undergraduates, graduate students, and practicing learning disabilities specialists. Amsterdam is a major center for study and treatment of learning disabilities, and the program utilizes guest lecturers from institutions in Amsterdam and elsewhere in the Netherlands. Students live in apartments of the university guesthouse. For further information see Professor Lucy Davis, Program in Education, 213C West Duke Building.



*The Netherlands, Amsterdam, Economics.* The Summer Session Office and the Department of Economics offer a two-course, six-week program in economics at the City University of Amsterdam focusing on an introduction to economic thinking and the political economy of a pluralist society. Both courses are taught in English. Students live in dormitory-style facilities. For further information see Professor Neil de Marchi, Department of Economics, 318 Social Sciences Building.

*Soviet Union.* The Summer Session Office and the Department of Slavic Languages offer a two-course, six-week summer program in Leningrad. Russian language study at different levels is offered, as well as a course in Russian culture. Extensive excursions to Moscow and other cities are included in this program. Classes in Leningrad are taught at Leningrad State University by faculty of the university. Students live in dormitories. For further information see Professor Edna Andrews, Department of Slavic Languages, 321C Languages Building.

*Spain.* The Summer Session Office and the Department of Romance Studies offer a two-course, six-week program at the advanced level in Madrid and Malaga with excursions to Toledo, Segovia, Granada, Sevilla, Cordoba, and Gibraltar. All courses are conducted in Spanish, and students live with Spanish families. For further information see Professor Miguel Garci-Gómez, Department of Romance Studies, 205 Languages Building.

*Taiwan.* The Summer Session Office and the Departments of History, Anthropology, and Sociology offer a two-course, six-week program at National Taiwan University in Taipei focusing on modern Chinese society and development issues of East Asia. Students live in dormitories. The program begins with a week in Seoul, Korea and concludes with a three-day excursion to Hong Kong. For further information inquire at the Summer Session Office, 121 Allen Building.

*Zimbabwe/Botswana.* The Summer Session Office and the Department of Political Science offer a two-course, six-week program based for three weeks at the University of Zimbabwe in Harare and for three weeks at the University of Botswana in Gabarone. The courses focus on politics and development of southern Africa and are taught in English by Duke faculty with guest lecturers from the Universities of Zimbabwe and Botswana. The program includes study trips to development projects, and excursions to Victoria Falls and Hwange (Wankie) Game Park. Students live in dormitories. For further information, see Professor Sheridan Johns, Department of Political Science, 214 Perkins Library.

## **DUKE UNIVERSITY MARINE LABORATORY**

The Duke University Marine Laboratory (DUML) is located adjacent to the historic seacoast town of Beaufort, North Carolina, with direct access to the Atlantic Ocean, Cape Lookout National Seashore Park, the Outer Banks, estuaries, sand beaches and dunes, wetlands, and coastal forests. Because of the richness and diversity of its flora and fauna, the area provides an excellent opportunity for marine study. The Marine Laboratory is an interdepartmental teaching and research facility of the University. The departments and programs which are chiefly concerned are biochemistry, biology, cell biology, chemistry, and geology. Academic programs include a spring term and a fall term for undergraduates and three terms of summer school for undergraduate and graduate students as well as a cooperative academic program for students from several colleges and universities. For information concerning application and registration, write to Admissions Office, Duke University Marine Laboratory, Beaufort, North Carolina 28516.

## **AGREEMENTS WITH OTHER UNIVERSITIES**

**Neighboring Universities.** Under a plan of cooperation, the interinstitutional agreement among Duke University and the University of North Carolina at Chapel Hill, North Carolina State University at Raleigh, and North Carolina Central University in Durham, a student regularly enrolled in Duke University and paying full fees may enroll for one approved course each semester at one of the institutions in the cooperative program. If

the student takes two or more courses during a summer at Duke, one of the courses may be taken at one of the neighboring institutions under this plan. This agreement does not apply to contract programs such as the American Dance Festival.

Approval forms for courses to be taken at these neighboring institutions may be obtained from the offices of the academic deans at Duke. Ordinarily, only those courses not offered at Duke will be approved. Credit so earned is not defined as transfer credit since grades in courses taken under the interinstitutional agreement are entered on the official record and used in determining the quality point ratio. The student pays any special fees required of students at the host institution and provides transportation.

**Howard University.** Duke students participating in the Duke/Howard University Exchange Program may spend a semester studying at Howard University in Washington, DC, while Howard undergraduates enroll for the same period at Duke. More information about this program, administered by Trinity College, is available at 2022 Campus Drive.

## **DUKE FUTURES PROGRAMS**

Initiated in 1985, Duke Futures Programs offers undergraduates the opportunity to explore a wide range of career interests through participation in summer and academic year internships and jobs. Opportunities are arranged through the Futures Job Network or made available through the general employment and internship listings in the Duke Futures office.

The Futures Job Network provides sophomores and juniors with firsthand experience in a field related to their academic program or future career. Internships are paid and are for at least a twelve-week period during the summer. Students can register throughout the academic year prior to the summer in which they wish to work. Positions are developed by a network of alumni volunteers located primarily in thirteen U.S. cities. Paid internships are also available in the community service sector through the Futures Service Learning Project. Two scholarships are available to students placed through the program. The Academic Scholarship is a merit award of \$750 for an independent study course relevant to the student's internship. The Opportunity Scholarship is a need-based award that replaces all or part of the summer savings expectation for students on financial aid, enabling them to accept the most attractive job offer.

Through other services such as individual counseling, resume workshops, interview technique seminars, a resource library, on-campus corporate summer recruitment, and monthly job bulletins, Duke Futures Programs helps students to prepare for the transition from their academic career to their work career.

## **Special Summer Programs**

### **DUKE SUMMER FESTIVAL OF CREATIVE ARTS**

The Duke Summer Festival of Creative Arts is administered jointly by the Summer Session Office and the Office of Cultural Affairs. The festival provides an exciting, artistically stimulating environment for the campus and community. The Ciompi Quartet, Duke's well-known Chamber Music Ensemble, will give several performances. Other special events such as jazz concerts, carillon recitals, dance and theater performances, and film series are planned.

**Summer Theater Institute.** The Summer Theater Institute, for students seriously interested in theater, offers intense professional-level training and experience. Courses involve substantial contact time and carefully-prepared assignments. Open primarily to Duke students, but with the permission of the Director of Drama, students from other institutions may attend.

Detailed information on faculty and courses may be obtained from Summer Theater Institute, 206 Bivins, Duke University, Durham NC 27708.

**The American Dance Festival.** The six-week program offers a wide variety of classes, performances, and workshops. For a catalog, write to the American Dance Festival, Duke University, Box 6097 College Station, Durham, North Carolina 27708.

### **PRECOLLEGE PROGRAM**

During the summer of 1989, Duke University will offer a Term II program for academically talented rising high school seniors from across the country. The Precollege Program is designed to provide the academic challenge of college-level courses to qualified college-bound students and to help prepare them for the adjustments they will be making when they enter college as freshmen. Students will enroll in two regular summer session classes with Duke undergraduates. Introductory level courses in the humanities, social sciences, natural sciences, and languages will be offered for college credit and there will be a wide range of campus programs and activities available as well. The students will live in supervised, air-conditioned University dormitories, eat their meals in the University dining halls, enjoy the opportunity of studying with distinguished members of the Duke faculty, and will have access to all University libraries and athletic facilities. Special programs organized by the residential staff will include sessions on such topics as research and study skills, communicative skills, health and physical fitness, selection of careers and colleges, and interpersonal relationships. For further information contact the Precollege Program, Duke University, Box 40077, Durham, North Carolina 27706-0077.



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*Campus Life and Activities*



## Student Affairs

The Division of Student Affairs strives to complement the educational mission of the University by helping to relate many of the nonacademic components of the University to the academic experiences of the students. The residence halls, the athletic fields, the Chapel, and many student organizations play an important humanistic and holistic role in the students' university experience by developing leadership qualities, skills in interpersonal relationships, and appreciation for the care of the physical self. Thus, the university experience encompasses collectively the life of the mind, body, emotions, and, indeed, the spirit.

## Residential Life

Duke has a long tradition as a residential university and has sought to provide convenient housing for the majority of the undergraduate students. While the University was established to provide a formal educational opportunity for students, Duke has always taken the position that education encompasses social and personal development as well as intellectual growth. In order to facilitate such a holistic approach, Duke seeks to provide a supportive environment substantially anchored in its residential program.

Although freshmen are required to live in the University residence halls, a number of upperclassmen choose to live off campus. Students enrolled beyond their fourth year of the undergraduate program cannot be granted space in University housing. Part-time and former students who have been readmitted are not eligible for on-campus housing.

**Residence Halls and Apartments.** The University accommodates approximately 90 percent of its undergraduates in sixty residence hall living groups located on East, West, and North Campuses and in apartments located on Central Campus. Within one of the residence halls, there are languages corridors for students interested in speaking French, Spanish, and German. Another residence hall houses the Women's Studies living group.

University housing is considered to include residence hall space as well as Central Campus Apartments. Placement in any of these areas fulfills the University's obligation to house eligible students in University housing. Free on-campus bus service connecting East, West, North, and Central Campuses is provided by the University.

Freshmen reside in all-freshman houses clustered on several campuses; upperclass students reside not only in all-upperclass residence halls but also in Central Campus Apartments. Residential fraternities are housed in sections of upperclass residence halls;

by tradition, sororities are not residential. Freshman housing assignments are made by lottery to the houses in the freshman clusters while upperclass housing assignments are made by a combination of lottery and student choice. Within the residence halls, students live in single, double, or triple rooms. Living groups elect officers and organize social, intramural, and cocurricular programs, and community service projects.

All of the residence halls have resident advisors who live in the houses and are members of the staff of the Dean for Residential Life. These graduate and undergraduate students have broad responsibilities in the residential life of the University including counseling students with personal problems, advising the house governments, and serving as resource persons for students.

**Residence Hall Programming.** Academic, cultural, and cocurricular programming is planned and presented throughout the year in the residence halls through the cooperative work of the Office of Residential Life, Trinity College of Arts and Sciences, the School of Engineering, and resident students. There are a number of faculty members in residence in both freshman and upperclass houses. Faculty offices and seminar rooms are also located in several of the freshman houses. The goals of these various residential programs are to enhance the quality of intellectual and social life for the residents on campus, to facilitate student-faculty interaction outside of the formal classroom, and to develop a greater sense of community within the individual residence halls as well as within the greater University.

**Living Off Campus.** The option of living off campus is available for students after the first semester of their freshman year, and those who choose it may retain their resident status and eligibility for University housing if they follow the proper procedures as published by the Office of Residential Life.

## Dining Facilities

All students living in campus residence halls are required to participate in one of five meal plan options and are able to select from a wide range of dining locations and a large variety of food offerings, all of which are available on their prepaid dining account (see “Food and Other Expenses” in the chapter “Financial Information”). In addition to all-you-can-eat cafeterias, University Food Services provides restaurants, snack bars, delis, and a pizza take-out and delivery service. Food service operations are located on each campus.

Facilities on East Campus include the East Court Cafeteria; the Magnolia Room, a formal seated restaurant; The Dope Shop, a snack bar; and the DownUnder, an a la carte restaurant featuring sandwiches and snacks. On West Campus, students may select from the University Room, an a la carte cafeteria; the Blue and White Room cafeteria; the Oak Room, a seated dining restaurant; the Cambridge Inn, a deli, pizza, and fast food shop. Arthur’s, located in Edens Quad on West Campus, provides late night snack services for the nearby living groups. The Boyd-Pishko Cafe, Licks, and the Rathskeller, located in the Bryan University Center, also serve West Campus. The Boyd-Pishko Cafe serves breakfast items, sandwiches, and snacks. Gourmet hamburgers, deli sandwiches, and salads are featured in the Rathskeller. On North Campus, there are the Trent Drive Hall cafe; The Sprout, a soup and salad bar; and the North Central Connection, a snack bar providing service during late evening hours. The Pub, a restaurant serving specialty sandwiches, is located on Central Campus. Catering services and pizza delivery are also available.

## Religious Life

Two symbols indicate how important religion has been to this University since its founding: *Eruditio et Religio*, the motto on the seal of the University, and the location of the Duke Chapel at the center of the campus. People from all segments of the University



and the community gather in Duke Chapel on Sunday morning to worship in a service which offers excellent liturgy, music, and preaching. The world's outstanding Christian preachers have preached from the Duke Chapel pulpit.

The University ministers work with the campus ministers and staff from the Roman Catholic, Jewish, and Protestant communities, and with other groups to provide a ministry which is responsive to the plurality of religious interests on the campus.

Through the religious life of the University, students are encouraged to search for meaning, to ask the ultimate questions, to worship, to meditate in the beautiful chapel, to learn from outstanding theologians from a wide array of traditions, and to work to bring about a more just and humane society.

## Services Available

**Student Health Service.** The objective of the Student Health Service is to provide medical care and advice to students. Both the Student Health Services Clinic and the University Infirmary are available to students for that purpose. A separate mandatory fee for this service is assessed and covers most services offered within the clinic and infirmary. Counseling and Psychological Services (CAPS), which is a separate and complementary service to the Student Health Service, provides a wide range of counseling and psychiatric services which are also covered by a portion of the Student Health fee. (See next section.)

The facilities of the Student Health Clinic are open during both regular and summer sessions to all currently enrolled full-time undergraduate students, as well as to regularly enrolled students in the graduate and professional schools. For treatment of illnesses or injuries, students should first visit the Student Health Clinic. Outside regular clinic hours, students should call or visit the University Infirmary, open twenty-four hours daily during regular academic sessions. The campus bus makes regular trips to the clinic; emergency transportation to the clinic, infirmary, or Duke Medical Center emergency room can be obtained from the Duke public safety officers or from ambulance services in Durham. Resident Advisors (RAs) should be consulted, whenever possible, for assistance in obtaining emergency treatment. For a description of the specific services provided by the clinic and also by the infirmary, see the *Bulletin of Duke University: Information and Regulations*.

The health education staff, located within the student health facility at Pickens Building, is available to work with students in making informed decisions that lead to healthy lifestyles at Duke and beyond. Specific areas of concern and interest include alcohol and other drug usage, eating and nutrition, sexual activity, and stress management. Programs, meetings, and consultations are provided for both groups and individuals.

In addition to the Student Health Service, the University makes available a plan of accident and sickness insurance to cover students who are enrolled in the University. This plan is designed to complement services normally not accessible to students through the Student Health Service coverage; it covers students both on and off campus, at home, or while traveling between home and school during the interim vacation periods throughout the one-year term of the policy.

All full-time and part-time degree candidates are required to enroll in the student accident and sickness insurance policy, made available by the University, unless they show evidence that they are covered by other generally comparable insurance. This evidence of comparable coverage is given by completing the appropriate waiver statement contained in the remittance form of the University invoice. This statement requires that the name of the insurance company and the policy number be indicated as well as the signature of the student or parent. While this requirement may be waived by signing the appropriate space on the University invoice indicating a willingness to assume the medical costs of any sickness or accident, the Student Health Service strongly recommends that all students be covered by accident and sickness insurance.

**Counseling and Psychological Services.** Counseling and Psychological Services (CAPS) provides a comprehensive range of counseling and developmental services to assist and promote the personal growth of Duke students. The professional staff is composed of psychologists, clinical social workers, and psychiatrists experienced in working with young adults. They provide evaluation and brief counseling/psychotherapy regarding a wide range of concerns, including such issues as self-esteem and identity, family relationships, academic performance, dating, intimacy, and sexual concerns. Also provided is career counseling, in which students may receive career testing or work with a computerized career guidance system. A career library with sources of occupational and educational information is maintained. While students' visits with counselors are usually by appointment, emergencies are handled when they arise.

Each year, CAPS offers a series of self-development seminars focusing on skills development and special interests. Topics of previous seminars have included career planning, stress management, social development, communication enhancement, and understanding eating problems.

As Duke's center for administration of national testing programs, CAPS also offers a wide variety of graduate/professional school admission tests and professional licensure and certification examinations. The staff is also available to the entire University community for consultation and educational activities in student development and mental health issues affecting not only individual students but the campus community as a whole. They work with campus personnel, including administrators, faculty, student health staff, religious life staff, resident advisors, and student groups, in meeting needs identified through such liaisons. Staff members are also available to lead workshops and discussion groups on topics of interest to students.

CAPS maintains a policy of *strict confidentiality* concerning information about each student's contact with the CAPS staff. If a student desires that information be released to anyone, written authorization must be given by the student for such release. Evaluation and brief counseling/therapy as well as career and skills development seminars are covered by the student health fee. There are no additional costs for these services.

For additional information, see the *Bulletin of Duke University: Information and Regulations*, or call (919) 684-5100.

**Office of Placement Services.** The Office of Placement Services is the liaison between the University community and potential employers in business, education, nonprofit organizations, and government. The purposes of the office are to give Duke students opportunities to investigate career options prior to beginning the placement process and to assist seniors in identifying employment opportunities commensurate with their qualifications, interests, and desires. An extensive file of openings for permanent employment is available, as is a library of general information about careers and employers. Staff members are available to discuss career plans; permanent employment opportunities; interviewing techniques; and other related matters. Employer and graduate and professional school representatives visit Duke beginning in early October each year.

Preliminary exploration of career interests early in the student's academic career is possible through the Career Apprenticeship Program, which offers nonpaid experience in a variety of career fields. This program gives the student the opportunity to gain practical work experience and to broaden the educational experience by related fieldwork during the undergraduate years. Students may also use the Duke Network file to identify Duke alumni, representing a variety of career fields, who have agreed to talk with undergraduates about various career paths.

**Office of Minority Affairs.** The Office of Minority Affairs (OMA) is an interdisciplinary/student service component of the University which assists minority students in their adjustment to student life. Although OMA primarily counsels and advises students, the office is also involved in matters relating to policy and circumstances which affect minority students. Appropriate discussions are held with faculty, staff, parents, and/or students.

The office has designed and implemented a variety of programs which are aimed at maximizing students' potential for realizing their academic goals. Three major program components are included in these efforts:

*Duke PREVIEW Program (DPP).* This program introduces selected precollege students to academic and student life at Duke. Courses in English, computers, mathematics, and study skills are offered to incoming freshman students during the summer preceding matriculation. Individual, group, and peer counseling sessions in PREVIEW present students with the opportunity to exchange ideas regarding individual and group concerns.

*Counseling in Academic and Social Affairs (CASA).* CASA provides the ongoing leadership of a graduate counselor or undergraduate peer to each undergraduate minority student. The counselors visit with students on a regular basis, hold group discussions, and serve as sources of information and referral to all students.

*Tutoring Program.* This program maintains tutors in mathematics and the sciences on a regular basis for any students seeking assistance. Although many students come to the tutoring program through supportive academic personnel, most are self-referred. Tutoring is encouraged and should be arranged as soon as a need is perceived.

## Offices for Program Planning

**The University Union.** The University Union brings together undergraduate and graduate students, faculty, administrators, employees, alumni, and others through a broad program of lectures, concerts, performing arts, exhibits, games, festivals, crafts, special events, dances, and film and video presentations and productions. It is governed by a board comprised of representatives of virtually all segments of the University community; the board also governs the operation of the Bryan University Center, where the Union is located.

The Bryan University Center is the hub of cultural, social, recreational, cocurricular, and service activities for students and other members of the campus community. In addition to the Union, the Bryan Center also houses a cafe, a snack bar, three theaters, a video auditorium, a post office, bank services, an art gallery, meeting rooms, offices for student organizations, an information center, a ballroom, a crafts center, a game room, lounges, and a mall. Also located in the Bryan Center are the University stores which provide textbooks, supplies, trade books, magazines and newspapers, health and beauty aids, gifts, and wearing apparel.

**Office of Student Life.** The Office of Student Life develops and coordinates the new student orientation programs for freshmen and transfer students and works closely with the Freshman Advisory Council (FAC), which is composed of upperclass men and women who are selected for qualities of responsibility and leadership. The members of the Freshman Advisory Council are each assigned small groups of freshmen or transfer students. During Orientation Week, they welcome their new students and introduce them to the University; during the first semester, they continue their relationship with their students, helping them make the many adjustments to university life.

Other responsibilities of this office include coordinating the application of the general rules and regulations of the University, advising the participants in the judicial process, serving as a resource center for handicapped students, advising the Interfraternity and Panhellenic Councils, acting as a liaison with both the Student Health Service and the Department of Public Safety, and designing and implementing the Parents' Weekend program.

**Office of Student Activities.** The Office of Student Activities, located in the Bryan Center, is a resource for approximately three hundred University clubs and organizations.

The director and program associates are available for advice in planning events, for guidance in establishing new groups, and for information about activities of campus groups. The financial manager oversees the financial affairs of student groups, Greek



organizations, and residential living units. This includes processing their financial and payroll transactions; auditing certain financial accounts; offering bookkeeping, budgeting, and fund-raising workshops for treasurers; and providing financial advice on an ongoing basis.

The office offers a Complementary Education Program with instructional and programmatic aids to foster leadership, organizational, and financial skills among student leaders. An internship/career apprenticeship program provides students with opportunities to gain practical experience and develop job related skills in such areas as accounting, advertising, public relations, editing, administration, and data processing. Also, the office sponsors an annual Student Activities Day, coordinates Duke's participation in the Share Your Christmas Program, and participates actively in Black Student Weekend.

**Office of Cultural Affairs.** The Office of Cultural Affairs is responsible for the creation, coordination, and implementation of many of the cultural and popular programs which occur on campus. The office is directly responsible for the Duke Artists Series; the Chamber Arts Society Series; Quadrangle Pictures; the Summer Festival of the Arts; and the scheduling of Page Auditorium, as well as all campus activities. With the exception of athletic events, all campus entertainment programs which require tickets are handled by Page Box Office, an extension of the Office of Cultural Affairs. In addition to overseeing arts-related activities, this office assists in publishing and distributing the yearly edition of the *Duke University Calendar*.

**The Mary Lou Williams Center for Black Culture.** The Mary Lou Williams Center for Black Culture was dedicated in September, 1983, in memory of the "great lady of jazz" and former artist-in-residence whose name it bears. The culmination of the work and dreams of many people, the center exists to promote and preserve black expressive culture at Duke. It serves as a gathering place for black students, where they can learn more about the beauty and richness of their culture and can with pride share their heritage with other students and members of the Duke community in an atmosphere of racial harmony.

The center is composed of the Director's office, two lounge areas, a library, an art gallery, and a large meeting area. This is the site of a variety of programs planned by the Director and students, and it can also be reserved by all groups on campus.

**International House.** International House is the center of cocurricular programs for approximately five hundred students at Duke from sixty-seven countries, as well as for American students who are interested in other cultures, are considering study abroad (see the section on study abroad in the chapter "Special Programs"), or are planning to travel outside the United States. The International Association, sponsored by International House and composed of both American and foreign students, plans social and cultural programs which emphasize personal contact and informal exchange of ideas among students from diverse backgrounds. Included are weekly open houses with lectures, discussions, films, potluck dinners or parties; periodic trips outside of Durham; and an annual International Day on campus which draws visitors from throughout the area.

Programs of International House which assist students from abroad in participating in the life of the Duke and Durham communities include an intensive orientation program at the beginning of the academic year; the International Friend/Host Family Program, in which interested international students may become acquainted with American families or individuals; Duke Partners, in which an international student is paired with an American partner for weekly meetings to work on language and life skills; Speakers' Bureau, which arranges for international students to speak at civic and social groups as well as schools in the Durham community; and English conversation classes which meet four hours a week on campus.

International House also has a visa specialist on the staff who works with students from abroad in fulfilling the various immigration and tax formalities involved in coming to Duke. Further information may be obtained from International House, 2022 Campus Drive, (919) 684-3585.

## Student Organizations

**Associated Students of Duke University.** The Associated Students of Duke University (ASDU) is responsible for articulating undergraduate student thought on issues relevant to the University and for working to improve the educational process and University environment. The working philosophy of ASDU is that students have the right to participate in the University's decision-making process on matters that directly affect the student body.

The Executive Committee is responsible for the implementation of all legislative action and for the coordination of the organization. It consists of the President, four Vice-Presidents (Executive, Student Affairs, Academic Affairs, and Engineering), an Executive Secretary, an Administrative Secretary, an Attorney General, a Press Secretary, and a Director of Student Services.

The ASDU legislature is composed of representatives from each undergraduate living group on campus, representatives of students living off campus and on Central Campus, and representatives selected from the entire student body. Within the legislative branch, there are four committees (Academic Affairs, Student Affairs, External Affairs, and Buildings and Grounds) which initiate legislation and projects to benefit the student body. Another legislative committee, the Student Organizations Committee, is responsible for allocating the student activities fee paid by each undergraduate to various chartered clubs and organizations.

ASDU's services seek to aid every undergraduate during his/her Duke career. These services include a free legal assistance program, a check cashing service, a maternity/abortion loan fund, a bail loan fund, a ride-rider board, babysitting and typing files, the Safe Rides and Safe Walks Programs, and a student travel service.

**Cultural and Social Organizations.** The scope of the more than three hundred student organizations is suggested by a partial listing of their names: Alpha Phi Omega service fraternity, Black Student Alliance, Baptist Student Union, Cheerleaders, International Association, Duke Ice Hockey, Outing Club, Sailing Club, Model United Nations Club, Photography Group, and the N.C. Public Interest Research Group. Twenty-one national social fraternities and thirteen national sororities are represented on campus. They are governed by the Interfraternity and Panhellenic Councils, respectively.

Many opportunities are provided on campus in the areas of music and drama. The Chorale, Modern Black Mass Choir, Chapel Choir, Wind Symphony, Marching Band, Symphony Orchestra, and Collegium Musicum are examples of musical organizations. Duke Players perform established and experimental drama; Hoof 'n' Horn presents musical comedy; Karamu performs drama related to the black experience.

Several academic departments sponsor organizations and programs for students with special academic or professional interests. There are over twenty academic department majors unions on campus. There are also academic and leadership honorary societies.

**Media.** The Duke *Chronicle*, the campus newspaper, publishes five issues weekly and is governed by the Chronicle Board. A humor magazine (*Jabberwocky*), a literary magazine (the *Archive*), a special topics newspaper (*The Missing Link*), a feature magazine (*Tobacco Road*), a humanities review (*Eruditio*), a science magazine (*Vertices*), a photography magazine (*Latent Image*), and the *Duke Journal of Politics* are published on a regular basis by students. In addition, a *Teacher-Course Evaluation Book*, *The Student Guide to Duke*, *The Duke Women's Handbook*, and a comprehensive yearbook, the *Chanticleer*, are produced each year. These publications are under the direction of the Undergraduate Publications Board, which chooses the editors and business managers, and reviews the financial budgets of all such franchised publications. The *Duke Engineer*, the official student magazine of the School of Engineering, appears twice each year and contains articles on technical and semitechnical topics as well as other matters of interest to the school. WXDU 88.7 FM is the student-managed and programmed radio station, broadcasting to the Duke and



Durham communities. Duke Union Community Television (Cable 13) is operated by students and produces color television programs that are broadcast throughout the campus on the University cable system. It also produces *Yearbook*, Duke's video yearbook.

**Project WILD.** Project WILD (Wilderness Initiatives for Learning at Duke) is a unique student organization which, through the ideal of experiential education (learning through doing), tries to ease the transition period into college for Duke students. Run totally by students, the program strives to teach self-worth, group awareness, and an appreciation of nature. WILD, a ten-day course held prior to Orientation Week, runs backpacking crews through the North Carolina mountains. In addition to this August course, WILD also sponsors activities including weekend trips, house courses, March and May wilderness courses, and a year-round ropes course available to the entire University.

## Health, Physical Education, and Recreation

Besides offering a variety of classes (see the chapter "Courses of Instruction"), the Department of Health, Physical Education, and Recreation also sponsors numerous programs for all students in intramurals, sports clubs, and recreation.

The Intramural Sports Program provides an opportunity for every student to participate in organized recreation competition in fifty-two activities. The program is comprised of four major areas: men's intramurals, women's intramurals, co-rec intramurals, and



recreation programs. It is open to all graduate and undergraduate students as well as to faculty and staff of Duke University. Participation, not skill, is a major factor that is emphasized in the program.

More than thirty-one sports clubs have been chartered by Duke students for those with similar interests to participate in competition and recreational activities. Clubs vary from those which compete with clubs of other universities, such as soccer, rugby, and ice hockey, to those of a more recreational nature such as cycling, scuba diving, and sailing, and one which yearly presents several performances, the water ballet club.

The University's many recreational facilities, available to all students, include the championship Robert Trent Jones Golf Course, tennis courts (some lighted) on both campuses, swimming pools on both campuses, three gymnasiums, a weight training room, squash and racquetball courts, outdoor handball and basketball courts, an archery range, horseshoe courts, an all-weather track, numerous playing fields, jogging trails, and informal recreational areas. Tournaments in recreational sports are often organized and conducted by students. Students may reserve facilities and equipment at designated times.

## Intercollegiate Athletics

The Athletic Department fosters intercollegiate athletics by striving for excellence and by providing the best possible framework within which highly accomplished student athletes can compete. The department has a dual responsibility to provide a high-quality athletic program and environment so that all students have the opportunity to compete to the fullest extent of their abilities. Duke is a member of the National Collegiate Athletic Association and the Atlantic Coast Conference (ACC). The ACC consists of Clemson, Duke, Georgia Tech, Maryland, North Carolina at Chapel Hill, North Carolina State, Virginia, and Wake Forest.

The intercollegiate program for men includes football, cross-country, basketball, swimming, fencing, wrestling, indoor and outdoor track, baseball, golf, tennis, and lacrosse. The women's athletic program provides intercollegiate competition in basketball, fencing, field hockey, golf, soccer, swimming, tennis, volleyball, indoor and outdoor track, and cross country. Freshmen may participate on all varsity teams.

The Director of Athletics and Associate Director of Athletics provide departmental leadership and coordinate all athletic policies with the University Athletic Council. The council consists of representatives from the undergraduate student body, the faculty, the administrative staff, the trustees, and the alumni. The council meets with the Director of Athletics periodically during the school year. The chairman of the council is the official University representative at national and conference athletic meetings.

## The Duke Student Honor Commitment

"The Duke Student Honor Commitment" was proposed by the members of the class of 1982. Different from and in addition to the Judicial Code, the Honor Commitment is a personal commitment of honor and integrity which is self imposed and not enforced by an outside authority.

Following is a copy of this commitment:

A unique aspect of a liberal education is its attempt to instill in the student a sense of honor and high principles that extends beyond academics. An essential feature of Duke University is its commitment to an atmosphere of integrity and ethical conduct. As a student of Duke University I accept as my personal responsibility the vigorous maintenance of high standards of honesty, truth, fairness, civility, and concern for others.

My devotion to integrity establishes that I will not cheat in academic work, and that I will adhere to the established and required community code of conduct. According to the dictates of my own conscience, I will report behavior in violation of such established standards. In addition and beyond the requirements of any code or law, I confirm my own commitment to personal honor and integrity in all matters large and small. Even though the ideal of honor is an abstract one, by implementing this ideal, I join the men and women of Duke University in making the concept of honor a reality.

## Judicial System and Regulations

Duke University expects and requires of all its students full cooperation in developing and maintaining high standards of scholarship and conduct. Each student is subject to the rules and regulations of the University currently in effect, or which are put into effect from time to time by the appropriate authorities of the University. At the same time, the individual is responsible for decisions and choices within the framework of the regulations of the community, as Duke does not assume *in loco parentis* relationships.

Students, in accepting admission, indicate their willingness to subscribe to and be governed by these rules and regulations. They acknowledge the right of the University to take disciplinary action, including suspension or expulsion, for failure to abide by the regulations or for other conduct adjudged unsatisfactory or detrimental to the University.

Responsibility for prescribing and enforcing rules and regulations governing student conduct rests ultimately with the Board of Trustees of Duke University and, by delegation, with administrative officers of the University. In the undergraduate schools, and in the University as a whole, many of these rules have been established over the years by cooperative action between students, faculty, and administrative officers. Representative student organizations, such as student governments and judicial boards, and more recently, community-wide bodies of students, faculty, and administrators, have initiated proposals for policies and rules necessary to assure satisfactory standards in academic and nonacademic conduct. These proposals have been accepted by University officers and have become a substantial, if not all-inclusive, body of rules governing student life at Duke. For current regulations, refer to the *Bulletin of Duke University: Information and Regulations*.

Students in Trinity College of Arts and Sciences and in the School of Engineering constitute an undergraduate community whose members are subject to the Judicial Code of the Undergraduate Community. Violations of the code and of certain University regulations by individuals are adjudicated before the Undergraduate Judicial Board, composed of representatives of the student body, the faculty, and the administration. The Judicial Code of the Undergraduate Community, the constitution of the board, the procedural safeguards, and the rights of appeal guaranteed to students are published in the *Bulletin of Duke University: Information and Regulations* for the undergraduate community. As provided in the judicial structure of the University, each residential unit may have a judicial board which has jurisdiction over all offenses involving violations of regulations relating to dormitory procedures and social regulations not covered by the undergraduate community code or University policies and regulations. The Residential Judicial Board may function as an appellate body in cases involving appeals from the individual house judicial boards and has original jurisdiction over group violations of the code as well as in disputes involving two or more living groups. For further information, refer to the *Bulletin of Duke University: Information and Regulations*.

## Student Discrimination Grievance Procedures

The Duke University policy on nondiscrimination is set forth on the credits page of this bulletin. Procedures for investigation and remedy of any complaint and for appeal of any decision are detailed in the *Bulletin of Duke University: Information and Regulations*.

## Student Obligations and Requirements

Students are expected to meet academic requirements and financial obligations, as specified elsewhere in this bulletin, in order to remain in good standing. Certain nonacademic rules and regulations must be observed also. Failure to meet these requirements may result in dismissal by the appropriate officer of the University.





*Admission*



## Principles of Selection

James B. Duke, in his Indenture of Trust, requested that “great care and discrimination be exercised in admitting as students only those whose previous record shows a character, determination, and application evincing a wholesome and real ambition for life.” In this light, and in view of the institution’s limited enrollment, Duke University looks beyond the basic characteristics of academic competence possessed by the majority of applicants. It seeks, in each prospective student, regardless of race, sex, color, religion, handicap, or national origin, not only evidence of intellectual promise and maturity of judgment, but also a degree of positive energy. Often, this energy is expressed in the form of special talents and accomplishments; it is seen consistently in a student’s determination to make creative use of the opportunities and challenges posed by Duke University.

## Requirements for Application

As there are occasionally changes in admission policies or procedures after the printing deadline for the *Bulletin of Duke University: Undergraduate Instruction*, candidates are urged to consult the *Bulletin of Duke University: Information for Prospective Students* for specific admissions information, dates, and policies.

### DEGREE STATUS

Although there are no inflexible requirements as to subject matter, students are urged to choose a broad and challenging high school program. At least twelve units of acceptable college preparatory work must be presented for review. Applicants to the School of Engineering are advised to take four units of mathematics and at least one unit of physics or chemistry.

The Scholastic Aptitude Test (SAT), given by the College Board, and three achievement tests (one of which must be English Composition, with or without essay) are required of all candidates for freshman admission and must be taken by the spring of the junior year for Early Decision and by January of the senior year for April Notification. Since placement in foreign language study and fulfillment of the foreign language requirement can be determined by an Achievement Test score, candidates who have studied a foreign language should take the Achievement Test in that language by June of the senior year in secondary school. Candidates may submit results of the American College Testing Program (ACT) in lieu of SAT and Achievement Test scores, provided the test is taken by December of the senior year for April Notification applicants and by June of the junior year for Early Decision applicants; the scores must be made available to the Admissions

Committee thirty days before the decision date. Candidates for the School of Engineering who elect to take the College Board test battery are required to take an Achievement Test in mathematics, either level 1 or level 2.

## NONDEGREE STATUS

**Summer Session.** Persons who are or were at the time of leaving their home institutions in good standing in accredited colleges or universities may be admitted for summer study only by the Director of the Summer Session.

**Continuing Education.** Admission as a nondegree student at Duke is limited to: people residing in the area who, because of family and work responsibilities, have no other access to education; Duke graduates of the preceding year; people who will be moving to the area and who will reside here for a substantial period of time; local high school students; and Duke University employees. These students are given academic and career counseling by the Office of Continuing Education; they are subject to most of the regulations set forth for degree candidates.

## Application Procedures

### DEGREE STATUS

*A Bulletin of Duke University: Information for Prospective Students*, which contains the first part of the application, may be obtained from the Office of Undergraduate Admissions, Duke University, Durham, North Carolina 27706. A nonrefundable processing fee of \$50 must accompany the first part of the application.

A personal interview at Duke is not required for admission; students who find it possible to visit the campus, however, may call or write for an interview. Area alumni interviews are also available for most applicants after Part I of the application has been filed. Interviews cannot be granted from January through April, when applications are under review.

**April Notification.** Candidates for admission to the freshman class must submit the first part of the application by December 1 and final applications no later than January 1 of their senior year in secondary school. Decisions are mailed from the University by April 15, and accepted candidates are expected to reserve a place in the class by May 1 with a nonrefundable deposit of \$500.

**Early Decision.** Students with superior credentials for whom Duke is a clear first choice may apply for early decision. Candidates who apply for early decision are required to sign a statement confirming their commitment to enroll at Duke if they are admitted in the early decision process and to withdraw applications from other colleges and universities as soon as they learn of their admission to Duke. Secondary school counselors and parents are also asked to sign the early decision agreement.

Students applying for early decision should submit the first part of the application by October 1. Deadline for final applications is November 1. The SAT or the ACT must be taken in the spring of the junior year. Achievement Tests should also be taken in the spring since early decision applicants who have not completed their Achievement Tests will be deferred to April notification. Applicants are notified of their status—admit, defer, or reject—by December 15. Admitted students pay a nonrefundable deposit of \$500 by January 5. The credentials of candidates who are deferred are considered along with those of students who request an April 15 decision. Deferred students are no longer bound by the early decision agreement and are free to accept offers of admission from other colleges and universities.

This plan is designed to give exceptional students who know Duke is their first choice a means of indicating that commitment to the University and of receiving a decision early enough to eliminate the necessity of applying to several colleges.



**Midyear Admission.** Midyear admission allows a limited number of freshmen to begin their college work a semester early or to postpone matriculation for a semester. Midyear applicants are expected to complete all the requirements for fall admission. The application deadline for new candidates is September 15 for the first part of the application and October 15 for the final application; students will be notified of the decision on their applications by November 15, with the expectation that those who are accepted will reply by December 1 with a nonrefundable deposit of \$500.

**Transfer Admission.** Transfer admission from other accredited institutions may be arranged for a limited number of students each semester. Because the transcript of at least a full year of academic work is preferred by the Admissions Committee, and because transfer students are required to spend their last two years at Duke, most candidates apply to Duke during their third or fourth semester in college. Candidates submit official transcripts of all work completed at other accredited colleges, high school records, scores on the Scholastic Aptitude Test, and employment records if there has been an extended period of employment since graduation from secondary school, along with completed application forms. See the section on transfer credit in the chapter "Academic Procedures and Information." Transfer students are eligible for university housing.

June (Term II, summer session) and September (fall semester) transfer students meet a March 1 deadline for the first part of the application and an April 1 final application deadline, learn of their decisions by May 15, and respond to the University by June 1 with a nonrefundable deposit of \$400 or \$500, if housing is requested. January transfer students submit the first part of the application by September 15 and final applications by October 15, learn of their decisions by November 15, and reply to the University by December 1.

## NONDEGREE STATUS

**Summer Session.** Application forms and schedules of courses may be obtained by writing or calling the Office of the Summer Session, 121 Allen Building, Duke University, Durham, North Carolina 27706; (919) 684-2621. No application fee is required.

**Continuing Education.** Applications may be obtained from the Office of Undergraduate Admissions and must be returned to that office, accompanied by a \$35 application fee, by August 1 for the fall semester and by December 1 for the spring semester.

A certain grade point average over four courses must be attained before a provisional degree student may petition for degree candidacy. More detailed information on non-degree course work through Continuing Education is available from the Office of Continuing Education, The Bishop's House, Duke University, Durham, North Carolina 27708.

## READMISSION OF FORMER STUDENTS

A student who desires to return, following withdrawal from college, should apply to the appropriate college or school. (See the section on readmission procedures in the chapter "Academic Procedures and Information.") Students who have been withdrawn from the University for five or more years must submit a new application to the Office of Undergraduate Admissions.

*Financial Information*



## Tuition and Fees

No college or university can honestly state that an education at the college level is inexpensive. Fees paid by students cover less than half the cost of their instruction and the operation of the University. Income from endowment and contributions from alumni and other concerned individuals meet the balance and assure each student the opportunity to pursue an education of unusually high quality.

Students are urged to give their attention first to the selection of institutions which meet their intellectual and personal needs, and then to the devising of a sound plan for meeting the cost of their education. This process will require an in-depth knowledge of both the University's financial aid program and the resources of the student's family. A brochure describing in detail the various forms of financial aid may be obtained from the Office of Undergraduate Financial Aid, Duke University, Durham, North Carolina 27706.

**Estimated Expenses.\*** Certain basic expenditures, such as tuition, room, and board, are considered in preparing a student's budget. These necessary expenditures, with a reasonable amount allotted for miscellaneous items, are shown below:

Tuition	Academic Year, 1989-90 (two semesters)	Two Summer Terms, 1989 (one semester equivalent)
Pre-1988 Matriculants	\$11,350†	\$3,684-\$4,298
1988 and Later Matriculants	\$12,800†	\$3,684-\$4,298
Residential Fee		
Single Room	\$2,312-\$3,034	\$1,348
Double Room	\$1,738-\$2,287	\$674
Food		
100% board plan	\$2,460	\$1,030
75% board plan	\$2,040	\$770
Books and Supplies	\$498	\$243
Student Health Fee	\$256	\$82

†For the School of Engineering, the tuition for pre-1988 matriculants is \$12,400; for 1988 and later matriculants, \$13,575.

It should be realized that additional expenses will be incurred which will depend to a large extent upon the tastes and habits of the individual. The average Duke student, however, can plan on a budget of approximately \$18,950 for 1988 and later matriculants and \$17,500 for pre-1988 matriculants for the academic year.\* The budget estimate for the summer (two terms, one semester equivalent) is \$6,250.\* These budgets are all-inclusive except for travel costs and major clothing purchases.

\*The figures in this section are projections and are subject to change.



**Registration Fees and Deposits for Fall and Spring.** On notification of acceptance, students are required to pay a nonrefundable first registration fee of \$40 and to make a deposit of \$460. The deposit will not be refunded to accepted applicants who fail to matriculate. For those who do matriculate, \$100 of the deposit serves as a continuing residential deposit for successive semesters, and the remaining \$360 serves as a continuing registration deposit.

*Late Registration.* Continuing students who fail to register during the registration period must pay a fee of \$50 to the Bursar.

*ROTC Deposit.* An Air Force ROTC deposit of \$10 is required of students enrolling in air science to cover possible loss of military equipment issued to them. This deposit is refunded to the student upon return of issued equipment.

*Part-Time Students.* In the regular academic year students who register for not more than two courses in a semester are classified as part-time students. Part-time students will be charged at the following rates: one course, pre-1988 matriculants \$1,419, 1988 and later matriculants \$1,600 (for engineering courses, \$1,550 and \$1,697); half course, pre-1988 matriculants \$709.50, 1988 and later matriculants \$800 (for engineering courses, \$775 and \$848.50); quarter course, pre-1988 matriculants \$354.75, 1988 and later matriculants \$400 (for engineering courses, \$387.50 and \$424.25). Registration for more than two courses requires payment of full tuition. Graduate students registered for undergraduate courses will be assessed three units for nonlaboratory courses and four units for laboratory courses. Men and women in nondegree programs who are being considered for admission to degree programs, as designated by the Office of Continuing Education, pay fees by the course at the pre-1988 matriculant rate whether the course load is one, two, or three courses.

Auditing one or more courses without charge is allowed for students paying full fees, provided that the consent of the instructor is obtained. Students who are enrolled for one or two courses may audit other courses by payment of \$142 for pre-1988 matriculants, \$160 for 1988 and later matriculants (\$155 and \$170 for engineering) for each course audited. With the consent of the appropriate instructor and the Director of Continuing Education, graduates of Duke may audit undergraduate courses for the above payment per course at the pre-1988 matriculant rate.

**Payment of Accounts for Fall and Spring.** The Office of the Bursar will issue invoices to registered students for tuition, fees, and other charges approximately four to six weeks prior to the beginning of classes each semester. The *total amount due* on the invoice is payable by the invoice late payment date which is normally one week prior to the beginning of classes. As part of the admission agreement to Duke University, a student is required to pay all invoices as presented. If full payment is not received, a late payment charge as described below will be assessed on the next invoice and certain restrictions as stated below will be applied. Failure to receive an invoice does not warrant exemption from the payment of tuition and fees nor from the penalties and restrictions. Nonregistered students will be required to make payment for tuition, fees, required deposits, and any past due balance at the time of registration.

*Multiple Payment Plan.* The Multiple Payment Plan allows students and their parents to pay part or all of the annual financial obligations for tuition, room, and board in nine equal installments. An annual nonrefundable participation fee is charged, but no interest is charged. The initial payment is made by check and subsequent payments are made by bank drafts. Questions regarding this plan should be directed to the Office of the Bursar, 101 Allen Building, (919) 684-3531.

*Guaranteed Tuition Plan.* The Guaranteed Tuition Plan offers undergraduate freshmen who are not recipients of University supported financial aid and their parents the opportunity of paying four years of tuition in forty-four installments. The tuition is guaranteed at the freshmen fall semester rate and financed at a set rate of interest. The initial payment is made by check and subsequent payments are made by bank drafts. Questions regarding this plan should be directed to the Office of the Bursar, 101 Allen Building, (919) 684-3531.

*Tuition Prepayment Plan.* The Tuition Prepayment Plan offers undergraduate freshmen who are not recipients of University-supported financial aid and their parents the opportunity of paying four years of tuition on or before July 31 preceding the start of the freshman year at the freshmen rate for the upcoming academic year. Future tuition increases will not be passed along to participants for the duration of their plan. Participants must also pay a nonrefundable participation fee.

*Late Payment Charge.* If the total amount due on an invoice is not received by the invoice late payment date, the next invoice will show a penalty charge of 1¼ percent per month assessed on the past due balance regardless of the number of days past due. The past due balance is defined as the previous balance less any payments and credits received on or before the late payment date and also any student loan or scholarship memo credits related to the previous balance which appear on the invoice.

*Restrictions.* An individual will be in default of this agreement if the *total amount due* on the student invoice is not paid in full by the invoice late payment date. An individual who is in default will not be allowed to register for classes, receive a copy of the academic transcript, have academic credits certified, be granted a leave of absence, or receive a diploma at graduation. In addition, an individual in default may be subject to withdrawal from school.

**Tuition and Fees for Summer Session.** Tuition for undergraduates is \$921 for each nonlaboratory or 3 semester hour (s.h.) course, \$1,228 for each laboratory or 4 s.h. course, \$614 for each half course (2 s.h.), and \$1,842 for each one and one-half course program (6 s.h.) offered at the Marine Laboratory.

Tuition for graduate students taking an undergraduate course is as indicated above.

*Health Fee.* All Duke students and all full-time non-Duke students are required to pay \$41 per term. All students at the Marine Laboratory are required to pay \$34 per five-week registration period.

*Studio Fee.* A fee of \$40 will be charged for each studio art class.

*Music Fee.* A fee of \$100 will be charged for Music 081 and 085. A fee of \$200 will be charged for Music 091 and 095.

*Auditing Fees.* With permission of the instructor and the Director of the Summer Session, students registered for a full course program (two courses) may audit nonlaboratory courses except physical education and dance activity courses, studio art courses, applied music courses and foreign programs. No extra charge is made.

Students carrying less than a full course program may be granted permission by the instructor and the Director of the Summer Session to audit a course (the above exceptions apply) but must pay half the University fee for the course.

*Payment of Tuition and Fees.* The University does not mail statements for summer session tuition and fees. All summer tuition and fees and any past due balance should be paid in the Office of the Bursar (101 Allen Building) at least five full working days prior to the first day of class (see Summer Session calendar). Students registering by mail may forward payment to the Office of the Bursar, 101 Allen Building, Duke University, Durham, North Carolina 27706. Students who fail to pay tuition and fees and/or otherwise fail to clear with the Bursar by the end of the drop/add period will be withdrawn from their courses. These withdrawn students will be billed the health fee and an administrative withdrawal fee of \$150 per course (\$75 per half-course) and receive a "W" for each course for which they were registered. (See the section on Refunds and Administrative Withdrawal Charges concerning penalties in this chapter). Students who, subsequent to withdrawal, clear with the Bursar may, with written permission of their academic dean, be reinstated in their classes as originally registered and receive regular grades instead of "Ws." The administrative withdrawal fee will stand and the student will be liable for full tuition and fees. Students who are unable to meet these deadlines should consult with the Bursar and their academic dean prior to the deadline.





*Late Fee.* Students who fail to register and pay all tuition and fees before five full working days prior to the first scheduled class day of a given course will pay an extra charge of \$25.

**Transcripts.** Requests for transcripts of academic records should be directed to the Associate Registrar. Ten days should be allowed for processing. A fee of \$2, payable in advance, is charged for each copy.

**Duke Employees.** With the permission of their supervisors, employees may, through the Office of Continuing Education, take up to two courses for credit or audit during any one semester or one during a summer term. A formal application for credit course work must be submitted by August 1 for the fall semester or December 1 for the spring semester. No formal application is required for auditing. Half-time employees with one or more years of service who receive permission to take such courses will be charged one-half the tuition rate shown above for part-time students during the fall and spring and one-half of the summer tuition rate. This benefit applies only to nondegree work. Full-time (thirty or more hours a week) employees with two or more years of service who receive permission to take such courses will be charged one-tenth the tuition rate for credit course work and will be permitted to audit at no charge. This benefit continues after degree candidacy has been attained. Eligible employees should consult the Benefits Office, 705 Broad Street (919) 684-6723, at least one week in advance of payment date to obtain the appropriate tuition voucher. The Director of Continuing Education is available to advise Duke employees on educational matters (684-6259).

## Living Expenses\*

**Housing for Fall and Spring.** In dormitories for undergraduate students the housing fee for a single room ranges from \$2,312 to \$3,034 for the academic year; for a double room, the fee ranges from \$1,738 to \$2,287 per occupant.

To reserve University housing for the fall semester, returning students who are eligible for and wish to occupy such housing must make a \$50 prepayment of the housing fee at a designated time during the spring semester.

Detailed information concerning the student's obligations under the housing contract and the consequences of failure to comply are published in the *Bulletin of Duke University: Information and Regulations*.

**Housing for Summer.** For detailed information on types and costs of accommodations available at Duke University for the summer session write: Department of Housing Management, 218 Alexander Avenue, Apartment B, Durham, North Carolina 27705.

**Food and Other Expenses.** University Food Services and Duke University Store operations are located on campus to serve the needs of the Duke community. The University identification card, known as THE DUKE CARD, can be used to gain access to prepaid accounts and make purchases in many Duke University facilities.

There are two accounts: the dining account, used to purchase food items in University Food Services and Duke Stores operations; and the flexible spending account, used to purchase any goods or services from Food Services, Duke Stores, and other operations.

All students living in campus residence halls are required to participate in the dining plan account and may choose one of five plans ranging in cost from \$660 to \$1,230 per semester. The flexible spending account is optional and may be set for \$50 or more.

Information regarding these accounts is sent to matriculating students. For more information about campus retail and food facilities, see the chapter "Campus Life" in this bulletin.

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\*The figures contained in this section are projections and are subject to change prior to the beginning of the fall 1989 semester.

## Fall and Spring Refunds

In the case of withdrawal from the University, students or their parents may elect to have tuition refunded or carried forward as a credit for later study according to the following schedule:

<i>Withdrawal</i>	<i>Refund</i>
Before classes begin	Full amount
During first or second week	80 percent
During third, fourth, or fifth week	60 percent
During sixth week	20 percent
After sixth week	None

Tuition charges paid from grants or loans will be restored to those funds on the same pro rata basis and will not be refunded or carried forward. In the event of death, a full tuition, fees, and residence hall refund will be granted. Also, the outstanding balance of the food service board plan will be refunded.

In the case of dropping special fee courses (e.g. music, art, golf), or of part-time students dropping audit courses, a full refund will be granted students during the drop-add period. Students changing status to part-time are required to request permission at the time of preregistration; therefore, no refunds are granted during the drop/add period or subsequently for changes which involve carrying less than a full-time load.

The registration deposit will be refunded to students whom the University does not permit to return, who graduate, or who request the refund prior to registration, thereby indicating their intention not to return for the following semester. The registration deposit will not be refunded to students who register for the following semester but fail to enter. Arrangements for refund of the \$100 residential deposit are described in the housing contract.

## Summer Administrative Withdrawal Charges and Refunds\*

*Drop or Administrative Withdrawal Charges.* Students who will not be attending a summer term or course for which they have registered (i.e., have submitted a course card) must officially drop the course(s) prior to the beginning of the term whether or not they have paid tuition and fees. (See the section on course changes for the summer term in the chapter "Academic Procedures and Information.") Students who fail to drop the course(s) prior to the beginning of the term will be charged \$150 per course (\$75 per half-course) plus the health fee.

*Refunds (Except Foreign Programs).* Students who will not be attending a summer term or course for which tuition and fees have been paid are eligible for refunds following these policies:

1. There is no refund of tuition and fees if the student drops a course(s) or withdraws from the term after the third day.
2. Full tuition less \$150 per course (\$75 per half-course) is refunded if the student officially drops a course(s) or withdraws from the term during the first three days. The health fee is not refunded. (There is no charge for drop/adds that result in no change in course load in the same term.)
3. Full tuition and fees are refunded if the student officially drops a course(s) or withdraws from the term before the first day.

## Student Aid

Duke University is strongly committed to its financial aid program and for the four years of undergraduate enrollment will meet 100 percent of the demonstrated need of

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\*This policy does not apply to foreign program students.

each eligible admitted student. The University's aid program includes both merit and need-based scholarships, work-study, the Pell grant program, the Perkins Loan (formerly National Direct Student Loan Program), the Stafford Student Loan Program (formerly Guaranteed Student Loan Program). Students needing assistance are strongly encouraged to apply for financial aid. Students receiving financial aid will be notified at the same time that they are offered admission.

For the student with demonstrated need, the net cost of an education at Duke University will generally be no greater than that for attendance at any college or university. It is the intention of the Office of Undergraduate Financial Aid to set each award at a level consistent with a student's ability to meet the costs of attending Duke University. This will be done by taking into consideration the contribution that can reasonably be expected from the student, the family, and any available outside sources. During the current academic year, over forty percent of the student body receives more than seventeen million dollars in aid of various types.

**Financial Aid for Entering Freshmen.** Candidates should initiate their application for financial aid concurrently with their application for admission during the fall semester of their senior year in secondary school. Instructions concerning the specific requirements and deadline dates will accompany application materials. The Financial Aid Form (FAF) must be submitted to the College Scholarship Service. In divorce cases, the University requires *both* parents to complete and submit a FAF which may be obtained either from a high school guidance counselor or from the Financial Aid Office. A notarized copy of all pages, including schedules and attachments, of the parents' and student's current Federal Income Tax Form must be submitted to the Financial Aid Office on or before May 1. Information provided on the FAF will be verified through the use of the tax return.

Financial aid recipients wishing to operate a motor vehicle on campus must first register it with the Financial Aid Office. As an automobile represents an asset, the value of a financial aid recipient's car will be considered in the estimation of a student's need. As a general rule, a student's annual contribution will be increased by 35 percent of the value of the car.

**Renewal of Financial Aid after the Freshman Year.** Each year students must file an application for renewal of financial aid. This application must include a new Financial Aid Form and a notarized copy of all pages, including schedules and attachments, of the parents' and student's current federal income tax return. Application packets may be picked up in the Financial Aid Office in mid-December.

To have financial aid renewed, a student must meet the continuation requirements outlined on pages 23, 24, and 41, 42, as appropriate. Students not qualifying for financial aid due to their inability to meet these requirements may appeal directly to the Financial Aid Office. Students holding merit scholarships are required to maintain an average considerably higher than the minimum required for need-based financial aid recipients. Specific details regarding retention standards are outlined on page 102 and will be provided to scholarship winners.

**Summer School Financial Aid.** Financial aid is available for each summer session. Interested students can obtain specific details as to available funding and an application through the Financial Aid Office in March of each year.

**Types of Financial Aid.** Gift scholarships or grants, long-term loans, and employment are integral parts of the financial aid program, and some portion of the aid offered an undergraduate is normally in each of these forms.

The work-study opportunity and loan(s) offered as financial aid are considered to be the self-help portion of the award. The standard aid package at Duke provides that the first \$2,500 to \$3,900 of each student's need be awarded in the form of self-help funds. Funds awarded in excess of this amount will generally be grant funds. This combination of University grant funds and opportunities for self-help enables Duke to extend its



resources to a larger number of deserving students. A student may choose not to accept any portion of an aid award with the understanding that the responsibility for providing the dollar equivalent is accepted by the individual.

Duke has several scholarships based on need which are available from personal endowments and corporations. Some are intended for entering freshmen, whereas others are awarded to upperclass students. These scholarships may be based on achievement in a particular field or on an outstanding overall record.

**Gift Scholarships.** The following are among the named gift scholarships offered through Duke University. Where specified, these scholarships are renewable for four (4) years for those students meeting the following academic standards:

Renewable merit scholarships will be continued for freshmen who complete the first year of studies with a 2.8 average or higher. Upperclass students must complete each academic year with a 3.0 average or higher. Students failing to meet these standards will be placed on probation for one semester during which they must maintain a 3.0 average or higher. Failure to maintain a 3.0 average or higher in subsequent semesters will lead to cancellation of the scholarship.

*Angier B. Duke Memorial Scholarships.* The Angier B. Duke Memorial Scholarships, competitively awarded on the basis of academic merit, have been established to encourage the intellectual achievement of men and women by recognizing those who possess outstanding academic and leadership abilities. Candidates are selected on the basis of intellectual performance, creative talent, and promise of being eventual leaders in whatever field of endeavor they choose. The scholarship is a four-year program (eight semesters), and a student's continuation in the program is contingent upon good academic performance. All 1988-89 freshman scholarship holders received \$11,340 if enrolled in Trinity College of Arts and Sciences, and \$11,950 if enrolled in the School of Engineering. Approximately twenty scholarships are awarded each year. Students demonstrating additional need will receive a grant from Duke University funds up to the amount needed. All Angier B. Duke Scholars participate in a six-week summer study program at Oxford University in England after the junior year. Under the program the scholarship pays tuition, single room accommodation, full board, designated excursions for all scholars, and an allowance for transatlantic air fare between New York and London. Those choosing not to participate in the Oxford program are eligible for a \$2,000 grant for an approved independent project. At least one of the four years of the scholarship could be used abroad on an approved program.

*W. N. Reynolds Memorial Scholarships.* Recipients of these awards are students with outstanding ability and/or need who show promise of constructive leadership. In considering candidates for the awards, consideration will be given in the following order: (1) children of employees of R. J. Reynolds Tobacco Company or any of its affiliates or subsidiaries; (2) children of families residing in Forsyth County, North Carolina; and (3) other candidates who are residents or natives of North Carolina. There are a number of awards available for each freshman class with a value of \$500 to \$3,900 annually.

*A. J. Fletcher Scholarships.* These music department scholarships are given to students who can demonstrate, by tape or audition, talent and achievement in instrumental or vocal performance. These awards are at least \$500 per year and are renewable annually for up to four years. Although recipients are not required to major in music, they are required to study privately and to participate in departmental performing groups.

*Lionel Hampton Scholarship.* This award of \$500 (not renewable) is given to an incoming freshman who demonstrates high proficiency in a musical instrument and strong potential in jazz performance.

*United Methodist Scholarships.* A number of United Methodist Scholarships are available on a basis of demonstrated need to Methodist students who have given evidence of leadership in their local Methodist Youth Fellowship groups.

*Alice M. Baldwin Scholarships.* One or more of these scholarships, varying in amount from \$500 to \$2,500, are awarded to women who are rising seniors in Trinity College of Arts and Sciences on the basis of scholarship, character, and leadership.

*Evelyn Barnes Memorial Scholarship.* One \$400 or two \$200 grants are awarded to undergraduate women who are contributing to the musical life of the University. Scholarship, character, and leadership are considered. Recommendation by a member of the music faculty is required.

*Panhellenic Scholarship.* A scholarship of approximately \$1,000 is awarded to an upperclass woman in Trinity College of Arts and Sciences on the basis of scholarship, character, leadership, and service.

*J. A. Jones Memorial Scholarships.* The scholarships, sponsored through the Jones Fund for Engineering, are awarded to engineering students whose outstanding academic and personal qualifications suggest that they will become leaders in a technological society. The awards range from a yearly sum of \$1,000 to \$3,000, depending on the degree of need.

*Robert H. Pinnix Scholarships.* The Robert H. Pinnix Scholarships are awarded annually to two upperclassmen enrolled in the Duke School of Engineering. The award is based upon demonstrated ability, excellence in engineering, and financial need.

*The Ellen P. and W. Clay Hamner Scholarship.* This scholarship covers the full cost of an academic year as well as providing a stipend to cover a foreign travel learning experience for one summer. This scholarship is available to graduates from public high schools in Georgia, Alabama, or North Carolina with preference to students from single parent families. Criteria include need, academic ability, and character. The scholarship is designed for a student studying in humanities with preference for those students who wish to enter the field of business upon graduation.

*Scholarships for Foreign Students.* A limited number of awards will be made each year to qualified students from other countries who enter as freshmen. Two named scholarships are awarded to currently enrolled foreign students: the Carol Cranmer Scholarship (named for a former student) and the Roberta Florence Brinkley International Scholarship (named for a former Dean).

*The Mary Duke Biddle Scholarship in Music Composition.* This scholarship with a stipend of \$3,500 per year is available to a member of each entering class. It is renewable from year to year so long as the student meets the required standards for renewal. Students wishing to apply for this award will be required to submit examples of their composition. Eligibility is limited to students planning to major in music.

*Air Force ROTC College Scholarship Program.* Students can apply for three-year scholarships during their freshman year and two-year scholarships during their sophomore year. Scholarships are available to students who qualify for flight training and to students who major in certain scientific or engineering fields. The scholarships include tuition, fees, and textbook reimbursement, plus a \$100 per month tax-free allowance.

*Army ROTC Scholarship Program.* All freshman and sophomore students are eligible to apply for Army ROTC scholarships. Awarded without regard to academic major, these grants pay tuition, fees, and textbook/equipment costs in addition to providing a tax-free monthly stipend of \$100 for the balance of the student's normal period to graduation. Commissioned service, following graduation, can be either on active duty or with the reserve forces. Additional information concerning Army ROTC scholarships is available from the professor of military science.

*Navy ROTC College Scholarship Program.* This program provides for up to four years' tuition and textbooks, laboratory fees, and a \$100 per month stipend. These scholarships, based upon academic achievement, leadership potential, and overall performance, can be awarded at any stage of the student's college career through either a nationwide selection process or by the Professor of Naval Science at the University. In addition, two other two-year scholarships are available to rising juniors: one leads to a career in nuclear power, and the other follows a summer attendance at the Naval Science Institute at Newport, Rhode Island. For further information on any of the above scholarship programs, contact the professor of naval science.

*The Minnie Happer Pruden Scholarships.* These scholarships of \$1,000 are available to the daughters of Episcopal clergymen.

*The Huguenot Scholarship.* One scholarship of \$1,000 per year is available from the Huguenot Society of America to a descendant of a Huguenot.

*Reginaldo Howard Scholarships.* These scholarships, awarded annually to freshman minority students, are provided to honor the late Reggie Howard, first black president of the student government. Seven scholarships for \$6,000 are awarded each year. Scholarships are available for the four years of undergraduate study as long as the student maintains the academic average specified for renewal.

*The Anne McDougall Memorial Award.* The Anne McDougall Memorial Award for Women is awarded each year to one woman student studying psychology or a related field. Administered through women's studies, this \$1,000 award is intended to provide encouragement and support for women who wish to pursue academic study and continue in the area of human service.

*Alumni Endowed Scholarships.* Two \$5,000 per year Alumni Endowed Undergraduate Scholarships are awarded to students who demonstrate superior academic ability and leadership potential. These awards are renewable annually for those meeting the stated requirements. Although not restrictive, preference is given to children of alumni.

## Scholarships for North Carolina Residents

*The Benjamin N. Duke Scholarship Fund.* Established by the Duke Endowment to honor Benjamin N. Duke, this fund is intended to encourage the enrollment of students from North Carolina and South Carolina.

*The Benjamin N. Duke Leadership Award.* As part of the Benjamin N. Duke Scholarship Fund, these awards recognize and encourage leadership potential and community involvement of students from North and South Carolina. Ten scholarships, valued at 75 percent of tuition, are awarded annually.

The Benjamin N. Duke Scholarship Fund also provides a number of grants which replace what would normally be the loan portion of need-based awards received by students from North Carolina and South Carolina. This allows need-based aid recipients from the Carolinas to graduate *debt free* following the eight standard semesters of enrollment.

*Trinity Scholarships.* Awarded to North Carolinians of exceptional ability, these scholarships are named to honor the fact that Duke University was originally named Trinity College. Trinity scholarships provide each winner an award equal to the value of tuition, fees, room, board, and the cost of a summer of study abroad.

*North Carolina Math Contest.* Upon enrolling at Duke, the top two students finishing in the top ten in the North Carolina Math Contest are eligible to receive a scholarship equal to the amount of tuition. This scholarship is available for each of the four years of undergraduate enrollment as long as the student maintains the specified average. Winners must have applied to and been accepted by Duke University.

*North Carolina Writer's Contest.* Among the top ten finishers in the state writing contest the top two matriculating at Duke will be eligible for full tuition scholarships. To receive these scholarships the winners must have already applied to and been admitted to Duke University. Each scholarship is available for the four years of undergraduate study as long as the student maintains the required average.

*Duke North Carolina Scholars Awards.* Scholarships funded by Duke University are awarded annually to selected incoming freshmen from North Carolina. Scholarships are renewable for the four years of undergraduate study as long as the student maintains the required average. Scholarships are valued at \$3,000.

*The Perry Family Scholarship.* Awarded to students from Winston-Salem and the Forsyth County area, this scholarship, valued at \$5,000, is awarded every other year. Recipients of the scholarship will be required to demonstrate high academic achievement as well as leadership and/or involvement in extracurricular activities. The scholarship is available for four years if the student meets the specified academic requirements.

*J. Welch Harriss Scholarships.* Recipients of these scholarships will receive \$1,000 per year without reference to need. If demonstrated need exceeds \$1,000, then the scholarship will be adjusted accordingly. These awards are made to entering freshmen who have achieved outstanding academic records. They are renewable each year as long as the student maintains the required average. Consideration will be given in the following order: (1) students from High Point, North Carolina; (2) students from Guilford County, North Carolina; and (3) students from North Carolina.

*Alyse Smith Cooper Scholarships.* Each year six or more scholarships of various amounts are awarded to students demonstrating both talent and need. Preference is given to students from Alamance County, North Carolina. Majors in music, particularly students of piano, organ, and voice, receive special consideration.

*Braxton Craven Endowed Scholarships.* Recipients of these scholarships will receive an amount equal to the current tuition at Duke. Braxton Craven scholars will be chosen on the basis of outstanding academic and extracurricular achievement. First preference is given to students from North Carolina. The scholarships are approved on a continuing basis, provided that the recipient complies with the specified academic requirements.

*The John M. and Sally V. Blalock Beard Scholarship.* These scholarships are awarded annually to outstanding students from the Wake County area of North Carolina who major in English or the History of the United States. These awards are based on financial need, scholarship, character, and academic achievement.

*North Carolina Legislative Tuition Grant.* The North Carolina General Assembly has established a program of tuition grants available to North Carolina residents who are full-time students at private colleges and universities in the State of North Carolina. The grant for each eligible student is \$1,100 per year. Applications will be mailed to all eligible students during the summer. In the case of a need-based financial aid recipient, this grant reduces a student's tuition and therefore his budget. All qualified need-based aid recipients are required to apply for this grant.

*State Contractual Scholarships for Needy North Carolinians.* Funds provided by the State of North Carolina through the Legislative Grant Program are distributed to needy North Carolinians qualifying for the State Contractual Scholarship Program. Application is made through the College Scholarship Service's Financial Aid Form.

*Employment.* Duke University offers subsidized employment opportunities to many students not qualifying for need-based financial aid. Interested students should submit the Financial Aid Form to the College Scholarship Service.

**Loans.** The loan programs which are available to students through Duke University are listed below:

*Perkins Loan.* Loan funds supplied by the federal government and Duke University through Part E of Title IV of the Higher Education Act of 1965 are available to qualified students. Repayment of loans under this act normally begins nine months after the student is graduated or leaves college, with complete payment scheduled within a ten-year period. Interest accrues at the rate of 5 percent annually, commencing nine months after the borrower ceases to be at least a half-time student at an institution of higher education. This loan is part of the student's financial aid award.

*Stafford Student Loan Program.* Loans under the Stafford Student Loan program are available from banks or other incorporated state lending agencies. Duke University can arrange an alternate lender for students who are unable to obtain these loans through their home state agencies or local banks. Need as established by the federal government's formula will be considered in the University's decision regarding applications. The annual limit on a loan, which has an interest of 8 percent for the first four years of repayment and 10 percent for the balance of the repayment period, is \$2,625 for freshmen and sophomores and \$4,000 for upperclass students. Repayment begins six months after the student leaves school.



Students may apply for Stafford loan funds by submitting a loan application directly to the Financial Aid Office. In addition, loan applicants must submit the Financial Aid Form to the College Scholarship Service. Additional information about this loan program may be obtained from the Undergraduate Financial Aid Office.

*Parents' Loan for Undergraduate Students Program.* Parents may borrow up to \$4,000 through the Parents' Loan for Undergraduate Students (PLUS) program. Repayment of these loans begins sixty days after loan disbursement. Interest is based upon treasury bill rates but will be no higher than 12 percent and begins to accrue at the point repayment begins. Interested parents should contact their home state lending agency.

*Supplemental Loans for Students.* Under the Supplemental Loans for Students (SLS) Program, independent undergraduate students are eligible to borrow up to \$4,000 per academic year at an interest rate between 12 and 14 percent. Repayment of the principal begins after the student is out of school six months, while interest payments are not deferred and are paid quarterly.

*Share Loans.* "Share" is a supplemental educational loan program developed specifically to help families meet the costs of higher education. Credit-worthy families, regardless of income, may be eligible to borrow through this program. Annual loan amounts range from \$2,000 to \$20,000 per year with a cumulative borrowing limit of \$60,000. The interest rate is variable, and Share offers several repayment options.

**Children of Methodist Ministers.** Children of ministers in the North Carolina and the Western North Carolina Annual Conferences of the United Methodist Church may be eligible to receive a partial tuition grant of \$750 per semester for a maximum of eight semesters of undergraduate study at Duke University. Eligibility is met by the parent being in a regular pastoral appointment and resident in one of the conferences. When the parent is in a special appointment and resident in one of the conferences, eligibility will be determined on an individual basis, depending upon the nature of the appointment. In all cases the decision of the University will be final.

**Employment.** Most financial aid recipients are offered a job as part of their aid package. These jobs require between ten and fourteen hours a week and provide an average stipend of \$1,600. The money is paid directly to the student. The Office of Undergraduate Financial Aid maintains part-time employment listings for the campus and Durham area. All students interested in working during the school year should inquire at the Financial Aid Office at the beginning of the semester. Every effort will be made to help students find jobs consistent with their interests.

Duke University also expects that students receiving financial aid will work during the summer. In the year before entering college, a freshman should save \$1,100 for use during the first year of college. In subsequent years, the student should save \$1,300 to be used for college expenses. These figures are viewed as estimates and are revised consistent with actual earnings.

**Tuition Plans.** Many families finance a college education with the assistance of an insured tuition payment plan regardless of whether they receive financial assistance from Duke. Although these plans are sponsored by a number of private firms, the University refers parents to plans provided by the Richard C. Knight Insurance Agency, Inc. The company provides the University with the full sum required each semester and arranges a schedule for monthly repayment by the subscribing families. The schedules for repayment vary with the program offered by the company. Additional information on this particular tuition payment plan may be obtained by writing to Richard C. Knight Insurance Agency, Inc., Insured Tuition Payment Plan, 53 Beacon Street, Boston, Massachusetts 02108.

Tuition payment plans are also available through the Tuition Plan, Concord, New Hampshire 03301. Each year the Tuition Plan will send information to all students.

*Courses of Instruction*



## Definition of Terms

Courses taught in 1987-88 or in 1988-89 or scheduled for 1989-90 are included in this chapter with full descriptions. Additional courses, which were taught prior to 1987-88 and are likely to be taught in the future, are listed separately by number and title only under the heading Courses Currently Unscheduled. For courses which will be offered in 1989-90, consult the *Official Schedule of Courses*.

Introductory level courses are numbered below 100; advanced level courses are numbered 100 and above. Courses numbered 1 through 49 are primarily for freshmen; courses numbered from 200 through 299 are primarily for seniors and graduate students. (See the section on course load and eligibility in the chapter "Academic Procedures and Information.")

Odd-numbered courses are usually offered in the fall semester, even-numbered courses in the spring semester. Double numbers separated by a hyphen indicate that credit is contingent upon completion of both courses. Double numbers separated by a comma indicate that although the course is a year course, credit may be received for either course or both courses.

The following symbols, suffixed to course numbers, identify the small group learning experiences: *S*, seminar; *P*, preceptorial; *T*, tutorial; *D*, discussion section. The *L* suffix indicates that the course includes laboratory experience. *C-L*: denotes a course that is cross-listed or a program under which a course is listed.

The following symbols, suffixed to course titles, identify the area of knowledge to which a particular course has been assigned: *AL*, arts and literatures; *CZ*, civilizations; *FL*, foreign languages; *NS*, natural sciences; *QR*, quantitative reasoning; *SS*, social sciences.

The following portion of this bulletin, arranged alphabetically, includes courses of departments, programs, and institutes, as well as categories of courses. Details are provided in the individual entries, which indicate whether a major is available in that particular field. A certificate, offered in some programs, is not a substitute for a major but is a supplement, confirming that a student has satisfied the requirements of that program.

## Trinity College of Arts and Sciences

Professor White, *Dean of Arts and Sciences and Trinity College*; Professor Spragens, *Associate Dean of Arts and Sciences and Trinity College*; Senior Associate Dean Wilson; Associate Deans Bryant, Nathans (Director of the Premajor Advising Center), Nijhout (Director of Health Professions Advising), and Wittig; Assistant Deans Lattimore, Roach, and Weller

## Aerospace Studies—Air Force ROTC (AS)

Professor O'Connor, Colonel, USAF, *Chairman*; Visiting Assistant Professor Bond, Captain, USAF, *Director of Undergraduate Studies*; Visiting Assistant Professors Kessler, Captain, USAF, and Snoddy, Captain, USAF



**Eligibility Requirements.** All freshmen and sophomores, men or women, are eligible to enroll in the General Military Course in the Air Force Reserve Officer Training Corps. For enrollment in the Professional Officer Course, the student must have completed successfully either the General Military Course or the six-week field training course; must execute a written agreement with the government to complete the Professional Officer Course; must be sworn into the enlisted reserve; and must agree to accept a commission in the U.S. Air Force Reserve upon graduation. In addition, each student must take at least one course in mathematical reasoning prior to graduation/commissioning. All students also will be required to attend one hour of leadership laboratory each week. All courses, except 2L, are open to all students with consent of instructor.

## General Military Courses

### *First Year*

**1. The Air Force Today.** Development of aerospace power in the United States; mission, doctrine, and organization of the U.S. Air Force and its relationship to the other services within the Department of Defense. (May not be counted to satisfy graduation requirements.) Half course. *O'Connor*

**2L. Leadership Laboratory.** Instruction in drill and ceremonies, wearing the uniform, giving commands, and other leadership activities. Mandatory for all Air Force ROTC cadets. Must be repeated each semester. Pass/fail grading only. No credit. *Staff*

### *Second Year*

**51. Development of Air Power.** Growth and development of air power from dirigibles and balloons to the present, emphasizing evolution of concepts and doctrine governing air power employment in support of national objectives. (May not be counted to satisfy graduation requirements.) Half course. *Snoddy*

## Professional Officer Courses

All students selected to continue aerospace studies pursue the following courses:

### *Third Year*

**105S. Aerospace Leadership and Management.** An introduction to management fundamentals to include the knowledge base and process of managing. One course. *Kessler*

**106S. Aerospace Leadership and Management.** Application of management fundamentals to duties as junior officers/executives to include principles of leadership. One course. *Kessler*

### *Fourth Year*

**205S. National Security Forces in Contemporary American Society.** The role of the professional military officer in a democratic society and the environment in which national security policy is formulated. One course. *Bond*

**206S. National Security Forces in Contemporary American Society.** The evolution of U.S. nuclear strategy, the international context in which national security policy is implemented, and the military justice system. One course. *Bond*

## Afro-American Studies Program (AAS)

A major is available in this program.

The program in Afro-American Studies provides instruction directed toward the experience and concerns of black America. The courses encompass the black experience in America and the black experience as illuminated by literary, religious, and cultural evidence generated by black Americans. The courses in the program are essential compo-

nents of a liberal arts education and may constitute a major or complement another major. In addition to the courses listed below, many related courses are offered. Descriptions can be found under the Departments of Anthropology, Economics, History, Political Science, Public Policy Studies, Religion, and Sociology. Swahili courses are described under Asian and African Languages. Further information is available in 04 Allen Building.

**49S. Freshman Seminar.** Topics vary each semester offered. One course. *Staff*

**56. The Black Religious Experience in America. (CZ)** See C-L: Religion 56. One course. *Lincoln*

**74. Introduction to Jazz. (AL)** See C-L: Music 74. One course. *Jeffrey*

**116. Race and Ethnic Relations. (SS)** See C-L: Sociology 116. One course. *Staff*

**138. Political Leadership in the Black Church. (SS)** See C-L: Religion 138. One course. *Lincoln*

**144. Black Cults and Sects in America. (SS)** See C-L: Religion 144. One course. *Lincoln*

**145, 146. Afro-American History. (CZ)** See C-L: History 145, 146. One course each. *Gavins*

**173, 174. Afro-American Literature. (AL)** See C-L: English 167, 168. One course each. *K. Williams*

**213S. Economics of Slavery in the American South. (SS)** Prerequisites: Economics 149 and consent of instructor. See C-L: Economics 213S. One course. *Coats*

**265. Religions of the West Africa Diaspora. (CZ)** See C-L: Religion 265; also C-L: Comparative Area Studies. One course. *Lincoln*

## THE MAJOR

Eight courses are required for the major. The course of study for each student is planned by the student and the student's advisor in the light of the student's interests and goals.

## Anthropology

A major is available in anthropology. For descriptions of courses and listings of faculty see Biological Anthropology and Anatomy as well as Cultural Anthropology.

### ANTHROPOLOGY COURSES BY FIELDS OF CONCENTRATION

Anthropology courses for undergraduates are offered in four fields, as noted below. Students majoring in anthropology are expected by the time of their graduation to have completed a concentration in one of the four fields.

**Ethnology.** Cultural Anthropology 49S, 101, 102, 105, 109, 110, 111, 113, 114, 122, 129, 130, 133, 134, 135, 136S, 137, 139, 140, 141, 142, 145, 147, 148, 151, 152S, 155, 156, 158S, 160S, 164, 165, 170, 173, 180, 180S, 189, 195S, 196S, 201S, 204S, 205, 206S, 215S, 228S, 234S, 237S, 239, 251S, 255S, 267, 272S, 275S, 280S, 281S. Courses on major world areas: Cultural Anthropology 120, 121, 123, 124S, 126, 127, 128, 131, 163, 282S.

**Linguistic Anthropology.** Cultural Anthropology 107, 112, 116, 118S, 119, 159, 211S, 258S.

**Physical Anthropology.** Biological Anthropology and Anatomy 132, 143, 144, 146, 172S, 180S, 185, 186, 187S, 195S, 196S, 238, 244S, 246S, 280S, 281S, 292.

**Archaeology.** Cultural Anthropology 99, 166, 167, 168, 241, 243.

## THE MAJOR

The major in anthropology is offered under the Bachelor of Arts degree.

*Major Requirements.* Eight courses in anthropology, two of which must be Biological Anthropology and Anatomy 93 and Cultural Anthropology 94. Concentration in one of

the four fields of the discipline must be accomplished by completing a minimum number of courses designated for the chosen field. The remaining courses to complete the required eight may be selected from other offerings of the two departments, either in the field of concentration or in other fields. Courses in each field of concentration are listed above, and the concentration requirements for each field follow:

*Ethnology Concentration.* At least three courses selected from the Cultural Anthropology offerings in ethnology, one of which must be a course from the list dealing with the cultures and societies of a major world area.

*Linguistic Anthropology Concentration.* At least three courses selected from the cultural anthropology offerings in linguistics, one of which must be cultural anthropology 107 or 119.

*Physical Anthropology Concentration.* At least three courses selected from biological anthropology and anatomy, one of which must be 132.

*Archaeology Concentration.* At least three courses selected from the cultural anthropology department's offerings in archaeology, one of which must be Cultural Anthropology 166.

*Recommended Courses in Anthropology beyond Basic Requirements.* Although an anthropology major consists of only eight required courses, students are encouraged to take additional courses both within their concentration and elsewhere in the two departments. The breadth of the discipline makes this desirable.

*Suggested Work in Related Disciplines.* Related courses in other departments are strongly advised. Each student's advisor will recommend a program of related work to complement the student's concentration and interests in anthropology.

*Honors.* Qualified majors are encouraged to participate in special work leading to graduation with distinction in anthropology. See the section on honors in this bulletin for general requirements. Any major with a B+ average (3.3 gpa) in anthropology courses and with a B average (3.0 gpa) in all courses is eligible. Students who desire to undertake honors work should request a member of the anthropology faculties to recommend their names to the Director of Undergraduate Studies. To receive departmental honors a major must complete a paper involving significant independent research or scholarship and pass an oral examination on the paper conducted by an appointed committee of faculty members, at least two of whom should be in anthropology. Normally, students will prepare their papers over the course of the senior year working in close collaboration with their committees and receiving on the average two course credits in independent study for the work.

## Arabic

For courses in Arabic, see Asian and African Languages.

## Art and Art History (ART)

Professor Spencer, *Chairman*; Associate Professor Wharton, *Director of Undergraduate Studies*; Associate Professors Bruzelius and Pratt; Assistant Professors Castriota, Cernuschi, Stiles, Sund, and Van Miegroet; Professors Emeriti Hall, Jenkins, Markman, and Sunderland; Adjunct Professors Lee and Mezzatesta; Adjunct Assistant Professor Reents-Budet; Artists-in-Residence Noland and Shatzman; Part-time Instructor Smith

Majors in Art History and Design are available in this department.

### HISTORY OF ART

Art history is intellectual history, providing students from all academic disciplines the opportunity to strengthen their powers of perception and expression and to bring together their various interests and different kinds of learning experiences. Art history is



the study of works of art in their historical context, that is, in the context of their cultural, religious, philosophical, and sociological conceptions. Studying art history develops the ability to evaluate and organize different kinds of information, and it enhances the faculties of creative imagination, precise observation, clear expression, and critical judgment. Students of art history acquire an appreciative awareness of the great aesthetic achievements of mankind and a sense of our cultural heritage.

A major or second major in art history is the appropriate preparation for students interested in art historical teaching and scholarship, in work in galleries, museums, and art publishing, or graduate work in architecture. Art history is also an excellent background for those planning careers in medicine, law, or other professions.

**69, 70. Introduction to the History of Art. (AL)** The history of western architecture, sculpture, and painting in a cultural context. 69: from prehistory to the Renaissance (c. 1400). 70: from the Renaissance to the present. One course each. *Staff*

**114. The Aegean Bronze Age. (CZ)** See C-L: Classical Studies 155. One course. *Younger*

**115. Ancient Greece. (CZ)** Prerequisite: Classical Studies 115, 53, 123, or 124, or History 53, or consent of instructor. See C-L: Classical Studies 147. One course. *Younger*

**116S. Athens. (CZ)** See C-L: Classical Studies 161S. One course. *Younger*

**117. Pompeii. (CZ)** See C-L: Classical Studies 162. One course. *Staff*

**120. The Art of Egypt and the Ancient Near East. (AL)** Art and architecture of the major urban centers of Egypt, Syria-Palestine, Mesopotamia, and Iran from the fourth millennium B.C. to the conquest of Alexander. Emphasis on architecture, sculpture, and painting. One course. *Castriota*

**121. The Art of Ancient Italy. (AL)** Art and architecture in Italy from the Villanovan period to the late Roman Republic. Emphasis on relations among the Etruscans, early Rome, and the Greek cities of the South. Not open to students who have had Classical Studies 126. C-L: Classical Studies 121. One course. *Castriota*

**122. Art and Myth in Ancient Greece. (AL)** Art in relation to myth in Greek society from the Orientalizing to the Hellenistic period. Emphasis on architectural sculpture and painting; connections between monumental and small-scale arts. C-L: Classical Studies 122. One course. *Castriota*

**123. Greek Art and Archaeology I. (AL)** See C-L: Classical Studies 123. One course. *Younger*

**124. Greek Art and Archaeology II. (AL)** See C-L: Classical Studies 124. One course. *Younger*

**125. The City in Antiquity. (CZ)** Urban architecture and city planning in the ancient Near East and the classical world. Forms and development of the urban environment as a function of religious, political, and economic factors from the beginnings of Mesopotamia to the centers of Hellenistic Greece and the Roman Empire. C-L: Classical Studies 125. One course. *Castriota*

**126. Rome: History of the City. (CZ)** See C-L: Classical Studies 145. One course. *Boatwright or Burian*

**128. Art of the Roman Empire. (AL)** Art and architecture in the Roman world from Augustus to Theodosius. Emphasis on portraiture, private arts, and triumphal monuments. Not open to students who have had Classical Studies 126. C-L: Classical Studies 128. One course. *Castriota*

**130. Late Antique and Early Christian Art. (AL)** Mediterranean arts and architecture from the second to sixth century A.D. The development of Christian art in Roman society. One course. *Wharton*

**131. Byzantine Art and Architecture.** (AL) Stylistic and structural developments in architecture, mosaics, frescoes, and icons in Byzantium from iconoclasm to the fall of Constantinople (ninth to fifteenth century), considered with their cultural context. C-L: Classical Studies 131. One course. *Wharton*

**132. Romanesque Art.** (AL) Western European art and architecture from the mid-tenth through the twelfth centuries. Influence of monasticism, the Crusades, and pilgrimages on the arts. C-L: Medieval and Renaissance Studies. One course. *Bruzelius*

**133. Gothic Art.** (AL) Western European art and architecture of the High Middle Ages to the early fifteenth century. Emphasis on the French contribution to the development of Gothic style. C-L: Medieval and Renaissance Studies. One course. *Bruzelius*

**134. Medieval Architecture.** (AL) The development of medieval architecture through the mid-fourteenth century. Emphasis on churches, with some discussion of castles and fortifications, town planning, and domestic architecture. C-L: Medieval and Renaissance Studies. One course. *Bruzelius*

**135. Gothic Cathedrals.** (AL) Major monuments of Gothic architecture in the twelfth and thirteenth centuries on the continent and in England with concentration on the great cathedrals of France. C-L: Medieval and Renaissance Studies. One course. *Bruzelius*

**136. Gothic Cathedrals.** (AL, FL) Same as Art 135, but taught in French. C-L: Medieval and Renaissance Studies. One course. *Bruzelius*

**141. Fifteenth-Century Italian Art.** (AL) Painting, sculpture, and architecture from Masaccio, Donatello, and Brunelleschi to Leonardo. Emphasis on the art of Florence. C-L: Medieval and Renaissance Studies. One course. *Spencer*

**142. Sixteenth-Century Italian Art.** (AL) Painting and sculpture in Rome and Florence: Michelangelo, Raphael, Leonardo. The rise and diffusion of mannerism: Pontormo to Tintoretto. C-L: Medieval and Renaissance Studies. One course. *Spencer*

**145. Renaissance Art in Florence.** (AL) Painting, sculpture, and architecture from Giotto to Michelangelo based on the works of art preserved in Florence. Emphasis on individual artists and their creations and on the relation of the artists to the society of their times. Closely integrated with History 182. (Taught in summer program in Italy.) One course. *Spencer*

**146. Italian Renaissance Architecture.** (AL) Development of building types and city planning in the fifteenth and sixteenth centuries in central and northern Italy. Emphasis on Brunelleschi, Alberti, Bramante, Michelangelo, and Palladio. C-L: Medieval and Renaissance Studies. One course. *Spencer*

**148. Art of the Netherlands in the Fifteenth Century.** (AL) Early Netherlandish painting with an emphasis on the innovations of the Master of Flémalle, Jan van Eyck, Rogier van der Weyden, and Hugo van der Goes; courtly and civic patronage of the visual arts in the cities of Flanders and Brabant; the cult of oil-based pigments and paintings as a mirror of nature. C-L: Medieval and Renaissance Studies. One course. *Van Miegroet*

**151. Art of Italy in the Seventeenth Century.** (AL) Caravaggio, the Carracci, Guido Reni, Domenichino, Bernini, and Poussin. Modes of description and narration; the concern with the status of pictorial representation; and the attempts to define and retrieve the canonical achievements of the early sixteenth century. One course. *Mezzatesta*

**152. Art of the Netherlands in the Sixteenth Century.** (AL) Introduction of new pictorial formats and functions in Netherlandish prints and paintings at the turn of the sixteenth century; Floris, Bruegel, and the definition of native idioms in the circle of Abraham Ortelius in Antwerp; the Haarlem community of engravers and theoreticians and the formulation of a history of Northern art at the close of the sixteenth century. C-L: Medieval and Renaissance Studies. One course. *Van Miegroet*

**153. Art of the Netherlands in the Seventeenth Century. (AL)** The descriptive subject categories and the alternative modes of representation formulated by Rubens, Rembrandt, and Vermeer. One course. *Van Miegroet*

**154. Art of Germany in the Fifteenth and Sixteenth Centuries. (AL)** A close examination of German art, from Konrad Witz to Albrecht Dürer and Hans Holbein the Younger; historical and artistic significance of the Councils of Konstanz and Basel; the revolutionary impact of the printing press; new trends in prints and sculpture; the beautiful and relatively unknown wood carvings created in Nuremberg between 1475 and 1515. One course. *Van Miegroet*

**161. Nineteenth-Century European Art. (AL)** Painting and sculpture of leading artists within the movements of neoclassicism, romanticism, impressionism, and symbolism. C-L: Comparative Area Studies. One course. *Cernuschi or Sund*

**162. American Art from Colonial Times to 1900. (AL)** The development of an American national school in portraiture, history painting, landscape, genre scenes, and still-life. Major figures include Copley, Bingham, Cole, Church, Whistler, and Eakins. One course. *Sund*

**164. Art of the Romantic Period. (AL)** Painting, sculpture, and architecture in France, England, Spain, and Germany from the late eighteenth century to the Revolution of 1848. The relationship of art to politics, changing concepts of genius and originality, the cult of styles, orientalism, and the emergence of landscape as a dominant art form. C-L: Comparative Area Studies. One course. *Sund*

**165. Topics in Oriental Art. (AL)** A critical survey of Chinese, Korean, and Japanese art from the earliest times to the nineteenth century. C-L: Comparative Area Studies. One course. *Lee*

**178. Pre-Columbian Art and Architecture. (AL)** A survey of the art and architecture of American cultures in Mexico, Central America, and Peru before the Spanish conquest. Particular emphasis on their political and religious functions, including the Olmec, Teotihuacan, Mayan, Aztec, and Inca civilizations. C-L: Comparative Area Studies. One course. *Reents-Budet or Sund*

**179. History of Event Art. (AL)** Post-1950s developments in Event Art—happenings, Fluxus, demonstrations, ceremonies, destruction art, body art, and performance art—considered theoretically and ideologically in the context of feminism, concrete poetry, New Music, and video. One course. *Stiles*

**181. The New York School: Art of the 1950s. (AL)** American art after World War II: abstract expressionism and the New York School. Emphasis on improvisation, gesture, and experimentation in the works of Pollock, de Kooning, Rothko, David Smith, Johns, and Rauschenberg. Historical influences and parallels with the other arts. One course. *Cernuschi*

**183. Twentieth-Century American Art. (AL)** Art of the twentieth century in the Americas. Emphasis on the development of regional styles and the emergence of the United States in the vanguard of modernism. One course. *Stiles*

**184. History of Impressionism. (AL)** The evolution of the impressionist movement and post-impressionist reactions of the 1880s. Particular attention to the work of Manet, Degas, Monet, Renoir, and Pissarro. C-L: Comparative Area Studies. One course. *Cernuschi or Sund*

**185. Post-Impressionism. (AL)** The emergence and development of post-impressionist styles—neo-impressionism, synthetism, symbolism—with emphasis on Seurat, Cézanne, Van Gogh, and Gauguin. The impact of post-impressionism on early



twentieth-century movements, including fauvism, expressionism, and cubism. One course. *Cernuschi or Sund*

**186. Twentieth-Century Art. (AL)** Modern art from 1900 to present. Emphasis on major movements, theoretical aims, and actual achievements. One course. *Cernuschi, Stiles, or Sund*

**187. Surrealism. (AL)** The surrealist movement that flourished in Paris between the World Wars: its origins, aims, and major adherents—such as the artists Miró, Magritte, Tanguy, and Dalí—examined in the context of surrealist literature, theory, and politics. One course. *Stiles*

**188. Twentieth-Century Criticism. (AL)** Twentieth-century art through the writings of its major proponents from Apollinaire and Roger Fry through Meyer Schapiro and Clement Greenberg to present-day theorists of postmodernism. The definition of modernism and the role of the critic as advocate, mediator, arbiter, and prophet of contemporary trends. One course. *Cernuschi*

**189. Modern Architecture. (AL)** Major movements in European and American architecture in the nineteenth and twentieth centuries with concentration on major architects and major buildings. Technical and theoretical bases; social and aesthetic implications. One course. *Wharton*

**191, 192. Independent Study.** Directed reading and research. Open only to qualified students in the junior year, by consent of Director of Undergraduate Studies. One course each. *Staff*

#### For Seniors and Graduates

**220S. Studies in Greek Art. (AL)** Specific aspects of the art or architecture in the Greek world from the late Geometric to the Hellenistic periods. Subject varies from year to year. Prerequisite: consent of instructor. C-L: Classical Studies 220S. One course. *Castriota*

**221S. Studies in Roman Art. (AL)** Selected topics in the art and architecture of late republican and imperial Rome. Prerequisite: consent of instructor. C-L: Classical Studies 227S. One course. *Castriota*

**222S. Greek Sculpture. (AL)** See C-L: Classical Studies 231S. One course. *Stanley*

**223S. Greek Painting. (AL)** See C-L: Classical Studies 232S. One course. *Stanley*

**224S. Greek Architecture. (AL)** See C-L: Classical Studies 233S. One course. *Richardson*

**225S. Roman Architecture. (AL)** See C-L: Classical Studies 235S. One course. *Richardson*

**226S. Roman Painting. (AL)** See C-L: Classical Studies 236S. One course. *Richardson*

**230S. Medieval and Byzantine Art and Architecture. (AL)** Conceptual, institutional, or stylistic topics. Subject varies from year to year. Prerequisite: consent of instructor. C-L: Classical Studies 230S and Medieval and Renaissance Studies. One course. *Wharton*

**232S. Romanesque and Gothic Art and Architecture. (AL)** Analysis of an individual topic. Subject varies from year to year. Prerequisite: consent of instructor. C-L: Medieval and Renaissance Studies. One course. *Bruzelius*

**242S. Studies in Italian Renaissance Art. (AL)** Specific problems dealing with iconography, style, or an individual master from c. 1300 to 1600. Subject varies from year to year. Prerequisite: consent of instructor. C-L: Medieval and Renaissance Studies. One course. *Spencer*

**243S. Studies in Northern Art. (AL)** Selected topics such as the Antwerp workshops of the sixteenth century, picturing in Haarlem at the turn of the seventeenth century, or Rubens and Rembrandt. Prerequisite: consent of instructor. One course. *Van Miegroet*

**261S. Studies in Romanticism. (AL)** Examination of the work of a single artist or the development of a specific theme or movement within the period 1760 to 1850. One course. *Sund*

**262S. Studies in Nineteenth-Century Art. (AL)** Focus on a major artist, movement, or trend in nineteenth-century art. Prerequisite: consent of instructor. One course. *Sund*

**276S. Studies in Modern Art. (AL)** Selected topics in modern art before 1945, with emphasis on major movements or masters. Prerequisite: consent of instructor. One course. *Cernuschi or Stiles*

**277S. Contemporary Art. (AL)** Historical and critical principles applied to present-day artists and/or movements in all media since World War II. Prerequisite: consent of instructor. One course. *Cernuschi or Sund*

**282S. Contemporary Theory in the Visual Arts. (AL)** Theory in contemporary art history and its accommodation to theoretical developments in other disciplines (for example, literature, women's studies, Marxism, and anthropology). Focus on the writings of contemporary, theory-centered art historians and critics. Prerequisite: consent of instructor. One course. *Wharton*

**291, 292. Independent Study.** Directed reading and research. Open only to qualified students in the senior year, by consent of Director of Undergraduate Studies. One course each. *Staff*

**293S. Methodology of Art History. (AL)** Approaches to the study and theory of art: historiography, connoisseurship, iconology, and criticism. Prerequisite: consent of instructor. One course. *Staff*

**294, 295. Special Problems in Art History. (AL)** Individual study and research. One course each. *Staff*

## DESIGN

To cover materials supplied in design courses, a fee of \$40 will be charged for each course, payable prior to the beginning of classes.

**53. Drawing.** Directed approaches to practice in life drawing and in the expression of graphic concepts. One course. *Shatzman or Smith*

**54. Two-Dimensional Design and Color.** Experiments in form and color, with work from observation. Introduction to color theory in various media. Prerequisite: Art 53. One course. *Smith*

**56. Sculpture.** Introduction to the principles and processes of sculpture. Prerequisite: consent of instructor. One course. *Noland*

**102. Figure Drawing. (AL)** The human figure through different artistic media and visual concepts. Prerequisites: Art 53 and 54, and consent of the instructor based on portfolio. One course. *Staff*

**103, 104. Painting. (AL)** Studio practice in painting with individual and group criticism and discussion of important historic or contemporary ideas. Prerequisites: Art 54 or equivalent and consent of instructor. One course each. *Pratt*

**105, 106. Advanced Drawing and Color. (AL)** Work from life or in formal modes, with emphasis on personal development, through individual and group criticism and discussion. Prerequisites: Art 53 and 54 and consent of instructor. One course each. *Pratt*

**108. Printmaking: Intaglio. (AL)** Studio course with directed problems in the intaglio medium including etching, aquatint, drypoint, black and white and color printing methods. Prerequisite: Art 53, 54, 107, or consent of instructor. One course. *Shatzman*

**109. Printmaking: Silkscreen. (AL)** Studio course on the silkscreen medium and its stencil-making process including paper, film, glue, tusche, and photographic methods. Prerequisite: Art 53, 54, 107, or consent of instructor. One course. *Shatzman*

**110. Intermediate Sculpture. (AL)** Studio practice in sculpture at the intermediate level. Group and individual discussion and critique. Prerequisite: Art 56 or consent of instructor. One course. *Noland*

**111. Advanced Sculpture. (AL)** Studio practice in sculpture at the advanced level. Group and individual discussion and critique. Prerequisites: Art 56 and 110, or consent of instructor. One course. *Noland*

**180S. Theory of Design. (AL)** Visual thinking and innovations in historical and contemporary art. Formal analysis and discussion of important issues for students involved in creating art. Prerequisites: two courses in design and consent of instructor. One course. *Pratt*

**203, 204. Advanced Painting. (AL)** Prerequisites: Art 53 and 54 and consent of instructor. One course each. *Pratt*

**207. Advanced Printmaking. (AL)** Studio course on advanced methods of color printing in the relief, intaglio, silkscreen, and monotype areas. Traditional and more experimental methods and the combinations of the included media. Prerequisite: Art 108, 109, or consent of instructor. One course. *Shatzman*

**208. Printmaking: Papermaking. (AL)** Studio course on handmade sheets for watercolor, printmaking, and drawing. Projects in combination with other studio areas. Prerequisite: Art 53, 103, 108, or consent of instructor. One course. *Shatzman*

**217, 218. Individual Project. (AL)** Independent work open to highly qualified seniors on recommendation of instructor and invitation of department. One course each. *Staff*

See also Institute of the Arts in this bulletin.

## COURSES CURRENTLY UNSCHEDULED

**107. Survey of Printmaking. (AL)**

**129. The Age of Justinian. (AL)**

**140. Giotto and the Origins of the Renaissance. (AL)**

**143. Classical Tradition in the Renaissance. (CZ)**

**144. Central Italian Art. (AL)**

**149. Death in Art. (AL)**

**150. Prints in the Fifteenth, Sixteenth, and Seventeenth Centuries. (AL)**

**160. Rococo to Neoclassicism: Eighteenth-Century European Art. (AL)**

**279S. Problems in Modern Architecture. (AL)**

## THE MAJOR

The student will elect a sequence of courses emphasizing either the history of art or design. The department offers work leading to graduation with distinction. See the section on honors in this bulletin.



## History of Art

*Major Requirements.* Either Art 69 or 70 is recommended, and one of them may be counted toward the requirement of eight courses in the history of art. The eight courses are to include: one course from each of the following areas—ancient, medieval, Renaissance/baroque, and modern; one seminar at the 200 level. For students planning to do graduate work in art history, one of these should be Art 293S. Two years of college level study or the equivalent in French, German, or Italian are strongly recommended. Majors contemplating graduate work in history of art are advised to take more than eight courses in history of art and to gain competence in French and German.

## Design

*Prerequisites.* Art 69 or 70 and one other art history course; Art 53 and 54.

*Major Requirements.* Five studio courses exclusive of Art 53 and 54.

## Institute of the Arts (AI)

Artist-in-Residence Cerveris, *Director*; Fellows Applewhite (English), Arcus (divinity), Bagg (music), Ball (drama), Berg (music), Bloom (music), Clum (drama and English), Coleman (music), Desmond (dance), Dickinson (dance), Dorrance (dance), El Guindi (drama), Fitzmorris (drama), Harris (public policy studies), Henry (music), Herman (drama), Hill (music), Hobbs (drama), Jaffe (music), Jeffrey (music), Kremen (psychology), Love (music), Ma (drama), McAuliffe (drama), Muti (music), Noland (art and art history), Parkins (music), Pope (English), Porter (English), Pratt (art and art history), Price (English), Raimi (music), Shatzman (art and art history), Smith (art and art history), St. Clair (drama), Szász (music), Troxler (music), Ward (philosophy), Williams (music), Wray (dance), and Wynkoop (music); Associate Fellows Azenberg (drama), Davis (dance), Hawkins (music), Kaiser (drama), Lally (drama), and Young (drama)

A certificate, but not a major, is available in this program.

The Institute of the Arts administers an undergraduate certificate program in the arts, offers interdisciplinary courses, sponsors artist residencies, coordinates and promotes activities in the creative and performing arts, and works to expand the role of the artist in a liberal arts setting. Courses, festivals, and events sponsored by the institute bring together faculty and students in different art forms to encourage an interdisciplinary perspective. All performing and creative artists who teach at Duke are fellows of the institute.

The Institute provides advisors for interdepartmental concentrations in the arts and assists students in designing individualized courses of study. A fall-semester off-campus residency program, the Duke in New York Arts Program, provides academic and professional experiences for selected juniors and seniors.

The Dance Program is administered through the institute, and courses in dance are listed below. Other institute courses and cross-listed courses are also described below; for courses and majors in art and art history, drama, English, and music see the departmental listings under those headings. For further information about the institute, inquire in 109 Bivins Building.

## DUKE IN NEW YORK ARTS PROGRAM

The institute-sponsored Duke in New York Arts Program offers an intensive, off-campus experience for a select group of juniors and seniors. The program has four components, each earning one credit: two seminars, an arts internship, and a course at New York University. The Duke courses are described below under Institute Courses. For information on admission to this program, contact the Institute of the Arts.

## INSTITUTE OF THE ARTS (AI)

**20S. Structure.** Does not count toward the divisional or fields of knowledge requirements. See C-L: Biology 45S. One course. *Wainwright*

**101S. Arts Resources in New York. (AL)** Investigation of a central theme through attendance at selected art events in the New York area supplemented by discussions, critical papers, and reports. Visiting Duke faculty members and New York practitioners in the arts provide guest lectures and lead discussions. Open only to those admitted to the Duke in New York Arts Program. One course. *Staff*

**102. Arts Internship in New York.** Immersion in the professional art world through apprenticeship to a sponsoring artist, scholar, or organization chosen to match each student's area of interest and expertise. Offered only on the pass/fail basis and open only to those admitted to the Duke in New York Arts Program. One course. *Staff*

**103S. Arts Production, Promotion, and Presentation in New York.** Analysis and investigation of the processes by which representative arts events and endeavors in New York are conceived, developed, produced, promoted, performed, and evaluated. Guest lectures by practitioners in these processes. Open only to students admitted to the Duke in New York Arts Program. One course. *Staff*

**110S. Video and Performance. (AL)** Creation of video works involving the performing arts in the context of contemporary critical theory. Prerequisite: consent of instructor. One course. *Desmond*

**115S. Film and Video Theory and Practice. (AL)** Prerequisite: Comparative Literature 177, Drama 65, or English 81. See C-L: English 83S; also C-L: English 183S, Drama 131S, and Film and Video. One course. *Staff*

**121S. The Diaghilev Ballet, 1909-1929. (AL)** Prerequisite: junior or senior standing or consent of instructor. See C-L: Dance 188S; also C-L: Interdisciplinary Course 188S. One course. *Dickinson and staff*

**122. The Arts as Human Experience. (AL)** The arts from an interdisciplinary perspective with special attention to historical and critical settings. Development of an understanding of the values and ideals at work in certain eras of culture and the arts through in-class and public performances, exhibitions, and presentations. One course. *Staff*

**123. Music Theater Practicum.** Staging, singing, acting, movement, and designing, explored in practical terms through analysis and direct involvement with these elements in workshop settings. Team taught. Pass/fail grading only. Prerequisite: consent of instructor. One course. *Staff*

**130. Inter-Arts: Theory and Practice. (AL)** Principles and techniques in contemporary interdisciplinary performance pieces, using combined art forms. Primary focus on the interrelationships of art forms and on collaboration among artists; analysis of such works as distinguished from more traditional artistic expression. Workshop in creation of a performed work. Half course. *Cerveris and staff*

**150. Managing the Arts.** Various aspects of planning, organization, promotion, resource development, and general operations of such typical arts organizations as arts councils, museums and galleries, subscription series, orchestras, and dance and theatre companies. Private, public, and governmental support for the arts. One course. *Silbiger*

**151S. Art and Its Making. (AL)** An inquiry into artistic process from a conceptual survey of dominant views to direct interviewing of and discussion with artists. Not open to freshmen. One course. *Kremen*

**191, 192. Independent Study.** Directed reading and research. Admission by consent of instructor and Director of the Institute of the Arts. One course each. *Staff*

## ARTIST IN RESIDENCE PROGRAM

The Nancy Hanks Artist Residency Program brings artists of great breadth and accomplishment to Duke to interact with students, faculty, and the community at large, in settings as diverse as formal courses, class visits, performances and exhibitions, informal workshops and seminars, and off-campus programs.

Courses by Nancy Hanks Resident Artists and by other visiting artists in the institute may not be listed in the bulletin since they vary from year to year. Consult the current course schedule and the institute for information about courses by artists in residence.

The Ciompi Quartet, a professional chamber music ensemble, is in residence in the Institute of the Arts all year. Members of the quartet also offer string instruction in the Department of Music. Consult that department's listings for applied music courses.

### Courses Currently Unscheduled

#### 120. Romanticism in the Arts. (AL)

## DANCE (DAN)

Associate Professor Wray, *Coordinator of the Dance Program*; Artists-in-Residence Desmond and Dickinson; Part-time Instructors Davis and Dorrance

The Dance Program offers its students the opportunity to study modern dance, ballet, dance history, choreography, repertory, and non-Western dance forms in an environment that challenges the student's intellectual, expressive, and physical capabilities. Emphasis is placed on both the acquisition of technical skills and the creative development of the individual student. Courses in technique, performance and production (half course credit), and theory courses (whole course credit) are offered. Dance theory courses fulfill humanities division and seminar requirements, and students may concentrate in dance through Program II. Activity courses are given only on a pass/fail basis.

### Activity Courses

**60. Beginning Modern Dance I.** A movement course exploring modern dance through technique, improvisation, and composition culminating in a class showing at the end of term. No previous dance experience necessary. Half course. *Staff*

**61. Beginning Modern Dance II.** Prerequisite: Dance 60 or equivalent. Half course. *Staff*

**62. Intermediate Modern Dance I.** Increased complexity of movement sequences and greater emphasis on clarity of expression and quality of performance. Prerequisite: Dance 61. Half course. *Staff*

**63. Intermediate Modern Dance II.** Continuation of Dance 62. Prerequisite: Dance 62 or equivalent. Half course. *Staff*

**65. Beginning Improvisation.** Exploration of space, time, and energy in movement and of improvisational structures. No previous dance experience necessary. Half course. *Staff*

**68. Ballet Fundamentals.** Fundamentals of classical ballet technique concentrating on correct placement and body alignment within the ballet vocabulary. No previous dance experience necessary. Half course. *Dorrance*

**70. Ballet I.** Barre work concentrating on body alignment and correct placement within the ballet vocabulary followed by center adagio and allegro sequences. Prerequisite: Dance 68 or equivalent. Half course. *Dorrance*

**71. Ballet II.** Greater complexity of barre and center sequences with increased emphasis on correctness of style and quality of performance. Prerequisites: Dance 70 or equivalent, and consent of instructor. Half course. *Dorrance*



79. **African Dance Technique.** Half course. *Davis*

80. **Individual Dance Program.** Half course. *Staff*

81. **Repertory.** The study of choreography and performance through participation in the mounting of a dance work from inception through rehearsal to performance. Prerequisite: consent of instructor. Variable credit. *Staff*

### Theory Courses

101. **Introduction to Dance.** (AL) Dance as a theater art including the choreographic process; technique in relation to style, form, content; the role of dance in society. One course. *Desmond, Dickinson, or Wray*

129S. **Dance as a Western Theater Art before 1900.** A history of theatrical dance, primarily European, with emphasis on developments that occurred after 1500. Illustrative topics: dance in ancient Greece; the Renaissance dancing master; *ballet d'action*; the romantic ballet; Petipa and classical ballet in Russia. One course. *Dickinson*

131. **Modern Dance: History and Theory I.** (AL) Same as 131S but in a lecture format. One course. *Staff*

131S. **Modern Dance: History and Theory I.** (AL) Modern dance, through the philosophy and work of its major artists considered in relation to the other arts and the sociopolitical climate of the period 1890 to 1950. One course. *Desmond, Dickinson, or Wray*

132S. **Modern Dance: History and Theory II.** (AL) See 131S, but from 1950 to the present. One course. *Desmond, Dickinson, or Wray*

133. **History of Black Dance.** (AL) A survey of black dance in Africa, America, and the Carribean during the eighteenth, nineteenth, and twentieth centuries. One course. *Davis*

135S. **Introduction to the Principles of Contemporary Dance Composition.** (AL) Basic compositional tools; sources of movement material; use of movement dynamics, variation, rhythm, and design in dance composition; methods of structuring group compositions from short movement studies to the more complex group pieces. One course. *Staff*

136S. **Advanced Contemporary Dance Composition.** (AL) Choreographing for less traditional performing areas; contemporary methods of composition; improvisation as a source of movement material and choreographic form. Prerequisite: Dance 135S. One course. *Staff*

181. **Special Topics.** Content to be determined each semester. Prerequisite: consent of instructor. One course. *Staff*

181S. **Special Topics.** Content to be determined each semester. Prerequisite: consent of instructor. One course. *Staff*

188S. **The Diaghilev Ballet, 1909-1929.** (AL) The Diaghilev Ballet as a focal point for modernist movements in the arts and a revitalizing force for ballet that brought together choreographers Fokine, Nijinsky, Massine, Nijinska; composers Stravinsky, Ravel, Debussy, Satie; artists Bakst, Benois, Picasso, Braque. Prerequisite: junior or senior standing or consent of the instructor. C-L: Institute of the Arts 121S and Interdisciplinary Course 188S. One course. *Dickinson and staff*

191, 192. **Independent Study.** Individual intensive research or creative projects. Half or one course. Prerequisite: consent of instructor. Variable credit. *Staff*

198. **Sacred Dance.** (AL) One course. *Wray*

## Courses Currently Unscheduled

- 64. Advanced Modern Dance
- 69. Jazz Dance
- 134. Creative Movement for Children
- 139. Movement Connotations
- 183. Dance and Dance Music, 1600-1800. (AL)
- 197. Aesthetics of Twentieth-Century Dance. (AL)

## Asian and African Languages and Literature

Associate Professor Cooke, *Director*; Assistant Professor Kunst, *Director of Undergraduate Studies*; Associate Professor Fowler; Assistant Professors Nagai, Wang, and Willis; Instructor Kuriya. Affiliated faculty: Professors Apte (cultural anthropology), Lawrence (religion), E. Meyers (religion), and O'Barr (cultural anthropology)

Asian and African Languages and Literature provides instruction in several languages, literatures, and linguistics of Africa and Asia. Languages offered are Arabic, Chinese, Hebrew, Hindi, Japanese, Korean, Persian, and Swahili. It offers Arabic, Chinese, and Japanese literature and linguistics courses, many in translation. Its courses are particularly compatible with a major in Comparative Area Studies.

### ARABIC (ARB)

**1, 2. Elementary Arabic. (FL)** Understanding, speaking, reading, and writing modern standard Arabic. Language laboratory. One course each. *Cooke*

**63, 64. Intermediate Arabic. (FL)** Reading, composition, and conversation in modern standard Arabic. Readings include selections from the Qur'an, contemporary literature, and the Arabic press. One course each. *Cooke*

**100. North African Culture. (AL)** Introduction to the culture of North Africa with special emphasis on the modern fiction of the area. (Taught in the summer program in Morocco, in English.) C-L: Comparative Area Studies. One course. *Cooke*

**155, 156. Advanced Arabic. (AL, FL)** Readings in classical and contemporary fiction and nonfiction. Works include al-Jahiz, Ibn Arabi, Abduh, Taha Husain, Ghada al-Samman and *1001 Nights*. Prerequisite: Arabic 64 or equivalent. One course each. *Cooke*

**173S. Women in Arabic Literature. (AL)** Taught in English. Representative novels, short stories, plays, and poems by writers (mostly female) in the Arab world. C-L: Comparative Area Studies and Women's Studies. One course. *Cooke*

**191, 192. Independent Study.** One course each. *Cooke*

## Courses Currently Unscheduled

**171S. Modern Arabic Literature in Translation. (AL)**

### CHINESE (CHN)

**1, 2. Elementary Chinese. (FL)** Introduction to speaking, understanding, reading, and writing modern standard Chinese (Mandarin, or *putonghua*, based on the Beijing dialect). One and one-half courses each. *Wang and staff*

**1A. Abridged Elementary Chinese. (FL)** Fundamentals of spoken and written modern standard Chinese (Mandarin). Intended for post-baccalaureate and summer session students. Prerequisite: consent of instructor. One course. *Staff*

**2A. Abridged Elementary Chinese II. (FL)** Prerequisites: Chinese 1A and consent of instructor. One course. *Staff*

**3. Literacy in Chinese. (FL)** An alternative to Chinese 1, 2 for fluent speakers of modern standard Chinese (Mandarin), with little or no reading and writing ability, who wish to make sufficient progress in one semester to advance to Chinese 64 in the spring semester. One course. *Staff*

**63, 64. Intermediate Chinese. (FL)** Reading, oral practice, language laboratory. One and one-half courses each. *Kunst and staff*

**125, 126. Advanced Chinese. (CZ, FL)** Contemporary nonfiction, films, and the media, concerning current political, social, and economic issues in China, Taiwan, and Hong Kong. Prerequisite: Chinese 63, 64 or equivalent. One course each. *Staff*

**141S. The Fantastic in Chinese Fiction. (AL)** A survey of Chinese narrative convention with special emphasis on the genre of the fantastic in premodern fiction. Topics include the influence of Chinese literary conventions and religious modes on the fantastic in tales and full-length novels. C-L: Comparative Area Studies. One course. *Wang*

**142S. Masterpieces of Chinese Literature in Translation. (AL)** Traditional fiction, drama, and poetry in their intellectual and social context. Chinese literature, from Chuang Tzu to the revolutionary era of the 1920s: poetry in a variety of genres, drama from the Yuan (Mongol) dynasty to Peking opera, and such novels as the eighteenth century *Dream of the Red Chamber*. C-L: Comparative Area Studies. One course. *Kunst*

**166S. The I Ching, or Book of Changes. (CZ)** Its place in ancient Chinese religion and systematic thought; its contributions to Chinese and world culture. Taught in English. C-L: Comparative Area Studies. One course. *Kunst*

**171. The Novel in Modern China. (AL, FL)** Reading and discussion in depth of a selected novel, with its cultural and historical background. Prerequisite: Chinese 125 or 126 or equivalent. C-L: Comparative Area Studies. One course. *Kunst*

**182S. Classical Readings in Chinese Philosophy. (CZ, FL)** An examination of early Chinese philosophies: Confucianism and Taoism in the classical texts. The sacred and the secular, political philosophies of Confucianism and Taoism, and the historical rise of the two schools. Taught in Mandarin Chinese. Prerequisite: Chinese 63, 64, 125 or 126. C-L: Comparative Area Studies. One course. *Wang*

**183, 184. Topics in Modern Chinese. (FL)** Readings and other material, including films, television, and radio broadcasts. Exercises in composition. Prerequisite: Chinese 125, 126, 127, 129, or consent of instructor. C-L: Comparative Area Studies. One course each. *Kunst or Wang*

**191, 192. Independent Study.** One course each. *Staff*

**Courses Offered in the Duke Study in China Program at Beijing Teachers College and Nanjing University**

**111, 112. Intensive Progress in Chinese. (FL)** One course each. *Staff*

**127. Chinese Conversation and Composition. (FL)** Discussion based on oral and written reports. Aural comprehension practice. One course. *Staff*

**129. Advanced Readings in Chinese. (CZ, FL)** Reading and discussion of selections from modern Chinese literature, expository prose, and the Chinese press. One course. *Staff*

**193. Directed Study.** Reading and research culminating in a paper, on a topic approved and supervised by the resident director. One course. *Staff*



## Courses Currently Unscheduled

135, 136. **Introduction to Modern Chinese Literature.** (AL, FL)

### HEBREW (HEB)

1, 2. **Elementary Modern Hebrew.** (FL) Introduction to speaking, understanding, reading, and writing modern Hebrew. Language laboratory. One course each. *Staff*

63, 64. **Intermediate Modern Hebrew.** (FL) Reading, composition, conversation, and language laboratory. Prerequisite: Hebrew 1, 2 or equivalent. One course each. *Staff*

191, 192, 193, 194. **Independent Study.** One course each. *Staff*

### HINDI-URDU (HIN)

1, 2. **Intensive Elementary Hindi-Urdu.** (FL) Conversation, basic grammar, and vocabulary; introduction to the Devanagari script and the reading of graded texts. Four hours of classroom work; two hours of language laboratory drill. One course each. *Staff*

63, 64. **Intensive Intermediate Hindi-Urdu.** (FL) Reading, composition, and conversation. Four hours of classroom work, two hours of language drill. Prerequisites: Hindi-Urdu 1 and 2. One course each. *Staff*

191, 192. **Independent Study.** Directed reading and research. Open only to students with prior knowledge of Hindi-Urdu. One course each. *Staff*

### JAPANESE (JPN)

1, 2. **Elementary Japanese.** (FL) Introduction to speaking, understanding, reading, and writing. One course each. *Nagai and staff*

63, 64. **Intermediate Japanese.** (FL) Practice on advanced spoken and written patterns; reading and discussion. One course each. *Kuriya and staff*

155, 156. **Readings in Modern Japanese.** (AL, FL) C-L: Comparative Area Studies. One course each. *Kuriya and staff*

161. **Modern Japanese Fiction in Translation.** (AL) An examination of the major forms of long and short fiction from 1890 to the present and the tradition from which they arose. C-L: Comparative Area Studies. One course. *Fowler*

175. **Structure of Japanese.** (AL, FL) Syntactic and semantic analysis of Japanese within the framework of current linguistic theory. Prerequisites: Japanese 1 and 2. C-L: Comparative Area Studies. One course. *Nagai*

183, 184. **Topics in Japanese.** (AL, FL) Readings and other material, including television and radio broadcasts. Exercises in composition. Prerequisite: consent of instructor. C-L: Comparative Area Studies. One course each. *Fowler or Nagai*

191, 192. **Independent Study.** One course each. *Staff*

193, 194. **Independent Study.** One course each. *Staff*

### KOREAN (KOR)

1, 2. **Elementary Korean.** (FL) Learning through self-instructional mode. Intensive work in language laboratory; drill sessions with native speaker; emphasis on conversation. Reading and writing in *hangul* script. One course each. *Kunst and staff*

63, 64. **Intermediate Korean.** (FL) Spoken and written Korean through self-instructional mode. One course each. *Kunst and staff*

191, 192. **Independent Study.** One course each. *Kunst*

## PERSIAN (PER)

**1, 2. Elementary Persian. (FL)** Introduction to spoken and literary Persian: understanding, speaking, reading, and writing. Language laboratory drill. One course each. *Lawrence*

**63, 64. Intermediate Persian. (FL)** Four hours of classroom work. Advanced reading and composition in classical Persian. Prerequisite: elementary Persian. One course each. *Lawrence*

**101. Introduction to Persian Literature. (AL, FL)** An introduction to classical Persian literature through the reading and translation of selected prose and poetry texts. Prerequisites: Persian 64 or the equivalent, and consent of instructor. One course. *Lawrence*

## SWAHILI (SWA)

**1, 2. Elementary Swahili. (FL)** Language instruction through self-instructional mode. Intensive work in language laboratory; drill sessions with native speakers. Emphasis on conversation. One course each. *W. O'Barr*

**14. Intensive Swahili. (FL)** Accelerated introduction to Swahili, combining in one semester the work of Swahili 1 and 2. Normally offered only in the summer. Two courses. *W. O'Barr*

**63, 64. Intermediate Swahili. (FL)** Classroom work and language laboratory drill. An advanced study of language, culture, and literature. One course each. *W. O'Barr*

**191, 192. Independent Study.** One course each. *W. O'Barr*

## Astronomy

For courses in astronomy, see Physics.

## Biological Anthropology and Anatomy (BAA)

Professor Kay, *Acting Chairman*; Associate Professor Glander, *Director of Undergraduate Studies*; Professors Cartmill, Hylander, Simons, and Terborgh; Associate Professors Smith and Van Schaik; Assistant Professors Bassett, Roth, and Wright; Associate Professor Emeritus Duke; Visiting Assistant Professor White

A major is available in anthropology.

Anthropology is a comparative discipline which studies the world's peoples, cultures, and the physical evolution of humanity. It emphasizes the application of the perspectives which anthropology developed from its initial concentration on the prehistoric and primitive world to modern studies of the evolution of complex societies, primate anatomy, and developmental biology.

Biological Anthropology and Anatomy is an interdisciplinary natural science department centering on the study of nonhuman and human primate origins and evolution. There are three general areas of focus in the department and its course work. (1) Primate behavior and ecology attempts to understand the behavioral relationship of humans to other primates. Significant opportunities for undergraduates are found at the Duke Primate Center which houses a unique and diverse range of nonhuman primates, especially prosimians from Madagascar. (2) Human and nonhuman primate evolutionary studies concentrate on the fossil evidence. Advanced students will find a range of opportunities to study original fossils and casts in laboratories at the Primate Center and in the Medical School. (3) Functional and developmental biology of primates provides laboratory opportunities to study nonhuman and human primate anatomy from an adaptive and evolutionary perspective.

Students without prerequisites for a course may ask the instructor for admission.

**49S. Freshman Seminar.** Topics vary each semester offered. One course. *Staff*

**93. Human Origins. (NS)** Origins and distribution; primate evolution; a survey of human paleontology and human biology, prehistory, and language; and the origins of human social organization and culture. One course. *Staff*

**93D. Human Origins. (NS)** Same as Biological Anthropology and Anatomy 93 except instruction is provided in two lectures and one small laboratory meeting each week. One course. *Staff*

**132. Human Evolution. (NS)** Evolutionary biology of the primates. Anatomical and behavioral adaptations and phylogeny of fossils and living primates including *Homo sapiens*. Prerequisite: Biological Anthropology and Anatomy 93 or equivalent. One course. *Cartmill, Glander, or Simons*

**143. Primate Biology. (NS)** A comprehensive survey of primate feeding strategies and general ecology. One course. *Glander, Simons, or Wright*

**144. Evolutionary Study of Behavior. (NS)** Phylogenetic comparison of communication, infant socialization, aggression, and sexual behavior as they pertain to species group structure. Emphasis on primates. One course. *Glander or Simons*

**146. Sociobiology and Gender. (NS)** Sociobiological theory reviewed and applied to the social behavior of free-ranging primates. The effects of gender on social behavior. One course. *Wright*

**151. Anatomy of the Lower Extremities.** Introduction to the functional anatomy of the lower extremities. Does not count for anthropology major requirements. Prerequisite: consent of instructor. One course. *Bassett*

**172S. Primate Anatomy. (NS)** The comparative anatomy of primates from the perspective of adaptation and phylogeny. Laboratory includes some dissection or prosection of human and nonhuman primates. One course. *Kay*

**180. Current Issues in Anthropology. (SS)** Selected topics in methodology, theory, or area. One course. *Staff*

**180S. Current Issues in Anthropology. (SS)** Same as Biological Anthropology and Anatomy 180 except instruction is provided in seminar format. One course. *Staff*

**185. Current Issues in Primatology. (NS)** Selected topics in primate behavior, ecology, and conservation. One course. *Glander or Wright*

**186S. Research Internship in Primatology.** Prerequisite: consent of instructor. See C-L: Interdisciplinary Course 186S. One course. *Staff*

**187S. Senior Seminar in Primatology. (NS)** Prerequisite: consent of instructor. See C-L: Interdisciplinary Course 187S. One course. *Staff*

**193. Independent Study.** Directed reading and research. Open only to qualified seniors, with consent of Director of Undergraduate Studies. One course. *Staff*

**195S, 196S. Senior Seminar.** Prerequisites: Biological Anthropology and Anatomy 93, a 100-level course in anthropology, and consent of Director of Undergraduate Studies. One course each. *Staff*

#### For Seniors and Graduates

**238. Functional and Evolutionary Morphology of Primates. (NS)** History and functional significance of locomotor and feeding adaptations, craniofacial morphology, sense organs, and reproductive systems in primates, including *Homo sapiens*. Prerequisite: consent of instructor. One course. *Staff*



**244S. Primate Behavior. (NS)** Social behavior of prosimians, monkeys, and apes and the evolutionary development of primates. One course. *Glander*

**246S. The Primate Fossil Record. (NS)** Evolution of humans and other primates as inferred from fossil remains. Prerequisite: a course in human evolution. One course. *Simons*

**280S, 281S. Seminar in Selected Topics. (NS)** Special topics in methodology, theory, or area. Prerequisite: consent of instructor. One course each. *Staff*

**292. Topics in Morphology and Evolution. (NS)** Various aspects of vertebrate morphology and evolution, including major historical approaches to the interpretation of morphology; the evolution, development, and function of specific morphological structures; and patterns of vertebrate evolution. Prerequisite: consent of instructor. One course. *Smith*

## THE MAJOR IN ANTHROPOLOGY

For a description of the anthropology major see the section Anthropology.

## Biology (BIO)

**Faculty in Botany:** Professor W. Culberson, *Chairman*; Professor Searles, *Director of Undergraduate Studies in Biology*; Professors Antonovics, Boynton, Christensen, Osmond, Ramus, Schlesinger, Siedow, Stone, Strain, White, and R. Wilbur; Associate Professor Knoerr; Assistant Professors Johnston, Kohorn, Mishler, and Vilgalys; Professors Emeriti Anderson, Billings, Hellmers, Kramer, Naylor, and Philpott; Adjunct Professor C. Culberson; Adjunct Associate Professor Patterson

**Faculty in Zoology:** Professor Gillham, *Chairman*; Professors Costlow, Fluke, Forward, Klopfer, Livingstone, McClay, Nicklas, H. Nijhout, Ruderman, Staddon, Tucker, Vogel, Wainwright, Ward, and H. Wilbur; Associate Professors Laurie, Lundberg, Rausher, Sutherland, and Uyenoyama; Assistant Professors Nowicki and Roth; Professors Emeriti Bailey, Bookhout, Gregg, Schmidt-Nielsen, and K. Wilbur; Adjunct Professor Schmidt-Koenig; Lecturer M. Nijhout

A major is available in biology.

The biology courses and the biology major are cooperatively administered by the Department of Botany and the Department of Zoology. Additional courses in biosciences are offered by the Departments of Biological Anthropology and Anatomy, Chemistry, and Psychology in Trinity College of Arts and Sciences; by the basic science departments in the School of Medicine; and by the Schools of Engineering and of Forestry and Environmental Studies.

Biology 21L and 22L constitute the normal introductory courses for students planning to major in the biological sciences and are prerequisites for intermediate and advanced courses in biology. The two courses may be taken in any order, and students majoring in biology may take their second course in the sequence concurrently with an intermediate level course, as appropriate. For nonmajors, either course, or both, may count for the distributional requirement in the natural sciences.

**10L. Marine Biology. (NS)** Physical and chemical characteristics of marine ecosystems and the functional adaptations of marine organisms to these systems. Lectures, field trips, and laboratories. For students not majoring in a natural science. Given at Beaufort. C-L: Marine Sciences. One course. *Staff*

**14L. Principles of Biology. (NS)** A one-semester introduction. Final time offered is fall 1989, open only to sophomores and above. One course. *Staff*

**19. General Biology.** This number represents course credit for advanced placement on the basis of the College Board Examination in biology. One course.

**21L. Introduction to Organismal and Environmental Biology. (NS)** The basic principles of genetics, population genetics, evolution, ecology, and physiology of animals and plants. The diversity and phylogeny of unicellular organisms and of plants. May be taken before or after Biology 22L. One course. *Staff*

**22L. Introduction to Cellular and Developmental Biology. (NS)** The basic principles of cell biology, photosynthesis, metabolism, molecular biology, immunology, and development of animals and plants. The diversity and phylogeny of animals. May be taken before or after Biology 21L. One course. *Staff*

**43. Ecology and Society. (NS)** Ecological concepts and their application to human society. Intended for nonscience majors. One course. *Staff*

**45S. Structure.** The structural design principles that underlie function, failure, and fancy in natural and manmade things. Gaps and connections between science and art. Lectures and tasks for minds and hands on worldly designs. Does not count toward the divisional or fields of knowledge requirements. C-L: Institute of the Arts 20S. One course. *Wainwright*

**49S. Freshman Seminar.** Topics vary each semester offered. One course. *Staff*

**53. Introductory Oceanography. (NS)** Basic principles of physical, chemical, biological, and geological oceanography. C-L: Geology 53. One course. *Pilkey and Searles*

**74L. Introductory Animal Diversity. (NS)** Structure, functions, and habits of animals; classification, evolutionary origins, and phylogenetic relationships of major extant groups. One course. *Rausher or Roth*

**85. Ecology and Natural History of North America. (NS)** Origin, distribution, structure, and function of ecosystems related to past and present patterns of geology, climate, and human land use. One course. *Christensen*

**90. Plants and Man. (NS)** The biological nature of crop plants, the world's major economic plants, and the origins and evolution of agriculture. One course. *W. Culberson or R. Wilbur*

**96D. Human Sex and Sexuality.** Anatomical, physiological, and psychological aspects of sexuality. Weekly lectures by specialists. Does not satisfy major, divisional, or fields of knowledge requirements. Pass/fail grading only. Half course. *Klopfer and staff*

**100. Perspectives on Living Systems. (NS)** For upperclass students not intending majors in a biological science. One course. *Staff*

**102. Trees and Shrubs of North Carolina. (NS)** Identification and natural history of the trees, shrubs, and woody vines. Emphasis on those cultivated or occurring naturally in North Carolina. One course. *R. Wilbur*

**103L. General Microbiology. (NS)** Classical and modern principles of the structure, physiology, and genetics of microorganisms and their roles in human affairs. Prerequisite: one course in a biological science or consent of instructor. One course. *Vilgalys*

**105. Introduction to Molecular Biology. (NS)** Concepts and techniques. Prerequisite: Biology 21L, 22L or Biology 14L. One course. *Staff*

**108L. Developmental and Comparative Anatomy of Vertebrates. (NS)** The embryology, anatomy, and evolutionary development of vertebrate organ systems. Prerequisite: Biology 21L, 22L or Biology 14L. One course. *Lundberg*

**110L. Ecology. (NS)** Physical, chemical, and biological processes that determine the distribution and abundance of plants and animals, emphasizing physiological responses, population dynamics, species interaction, biogeography, nutrient cycling, and energy

flow through food webs. Laboratory includes fieldwork. Prerequisites: Biology 21L, 22L or Biology 14L; and Mathematics 31. One course. *Christensen and H. Wilbur, or Livingstone and Schlesinger*

**111. Learning and Adaptive Behavior. (NS)** Prerequisite: none, but some knowledge of quantitative science desirable. See C-L: Psychology 111. One course. *Staddon*

**113L. Behavioral Ecology. (NS)** How ecological factors shape foraging, mating, aggressive and social behavior. Laboratory experiments and field observations from the Outer Banks environment. Independent projects and seminars. Not open to students who have taken Zoology 213L. Given at Beaufort. Prerequisite: Biology 21L, 22L or Biology 14L. C-L: Marine Sciences. One course. *Rubenstein*

**114L. Biological Oceanography. (NS)** Physical, chemical, and biological processes of the oceans, emphasizing special adaptations for life in the sea and factors controlling distribution and abundance of organisms. Laboratory emphasis. One course (spring); one and one-half courses (summer). Given at Beaufort. Prerequisite: Biology 21L, 22L or Biology 14L. C-L: Marine Sciences. Variable credit. *Ramus and staff*

**117L. Biology of Marine Macrophytes. (NS)** Physiology and ecology of seaweeds, seagrasses, marshgrasses, and mangroves. Biological flux of carbon and nutrients in coastal seas. Ecological consequences of photosynthetic adaptations. Given at Beaufort. Prerequisites: Biology 21L, 22L or Biology 14L; and Chemistry 11, 12 or equivalent. C-L: Marine Sciences. One course. *Ramus*

**120. Principles of Evolution. (NS)** Evidence for evolution; mechanisms of micro- and macro-evolutionary change. Genetic change in populations. Ecological, behavioral, molecular forces influencing genetic change. Speciation; phylogenetic reconstruction. Prerequisite: Biology 21L or Biology 14L. One course. *Antonovics*

**140L. Plant Diversity. (NS)** Major groups of living plants, their evolutionary origins and phylogenetic relationships. Prerequisite: Biology 21L, 22L or Biology 14L. One course. *Mishler, Searles, or R. Wilbur*

**142L. Plant Systematics. (NS)** Surveys major groups. Principles of vascular plant taxonomy with practice in identification of local flora. Lectures, laboratories, and field trips. One course. *Mishler and R. Wilbur*

**145. Physical Radiations and Biological Significance. (NS)** Kinds of physical radiations, related biological hazards and benefits. Levels of concern for plants and animals, including humans. Protection, cellular repair processes. Prerequisites: Biology 21L, 22L or Biology 14L; and Chemistry 12. One course. *Fluke*

**149. Comparative Biomechanics. (NS)** The structure and operation of organisms in relation to the mechanics of solids and fluids. Not open to students who have taken Biology 249. Prerequisites: Physics 51 and Mathematics 31 or equivalents. One course. *Vogel and Wainwright*

**150L. Physiology of Marine Animals. (NS)** Environmental factors, biological rhythms, and behavioral adaptations in the comparative physiology of marine animals. Given at Beaufort. Prerequisites: Biology 21L, 22L or Biology 14L; and chemistry. C-L: Marine Sciences. One course. *Forward*

**151L. Principles of Animal Physiology. (NS)** Functional aspects of respiration, circulation, neural and hormonal coordination, water balance, metabolism, thermoregulation, and responses to special environments. Prerequisites: Biology 22L or Biology 14L, and Chemistry 12. One course. *Tucker, Nowicki, or staff*

**152L. Plant Physiology. (NS)** Principal physiological processes of plants, including respiration, photosynthesis, water relations, and factors associated with plant morpho-



genesis. Prerequisites: Biology 21L or Biology 14L, and one year of chemistry; organic chemistry is desirable. One course. *Siedow*

**160. Principles of Cell Biology. (NS)** Structure and function of organelles, metabolism, and regulatory mechanisms. Prerequisites: Biology 22L or Biology 14L, and Chemistry 12. One course. *Kohorn, McClay, or M. Nijhout*

**160L. Principles of Cell Biology. (NS)** See Biology 160. Includes laboratory. One course. *Kohorn, McClay, or M. Nijhout*

**164. The Molecular Biology of Development. (NS)** Principles and problems of development and differentiation. Fertilization and early development; molecular and cellular mechanisms of determination, lineage determinism, embryonic induction and differentiation; developmental genetics, morphogenesis, and pattern formation. Includes attention to current literature. Prerequisites: Biology 22L or Biology 14L, and Chemistry 12. C-L: The University Program in Genetics. One course. *Ruderman*

**169L. Marine Communities. (NS)** Dynamics of marine communities in the context of current ecological theory. Life history strategies, competition, predation, diversity, and stability; detailed considerations of benthic and pelagic communities. Given at Beaufort. Prerequisites: Biology 21L, 22L or Biology 14L; and Mathematics 31. C-L: Marine Sciences. One course. *Sutherland*

**170L. Plant Anatomy. (NS)** A comparative study of basic cell types, tissues, and organs of vascular plants. Correlation of anatomical information with pertinent literature, application of anatomy to problems in systematics and evolution, and the interrelationship between structure and function. Prerequisite: Biology 21L, or Biology 14L plus Biology 140L, or consent of instructor. One course. *White*

**176L. Marine Invertebrate Zoology. (NS)** Structure, function, and development of invertebrates collected from estuarine and marine habitats. Not open to students who have taken Zoology 274L. One course (fall); one and one-half courses (summer). Prerequisite: Biology 21L, 22L or Biology 14L. C-L: Marine Sciences. Variable credit. *Kirby-Smith (marine sciences)*

**180. Principles of Genetics. (NS)** Structure and properties of genes and chromosomes in individual organisms and in populations. Prerequisite: Biology 21L, 22L or Biology 14L. C-L: The University Program in Genetics. One course. *Antonovics, Boynton, Gillham, and Laurie*

**191, 192. Independent Study. (NS)** For junior and senior majors with consent of Director of Undergraduate Studies and supervising instructor. Three courses of 191, 192, 193T, and 194T, maximum. Variable credit. *Staff*

**193T, 194T. Tutorial. (NS)** For junior and senior majors with consent of Director of Undergraduate Studies and supervising instructor. Three courses of 191, 192, 193T, and 194T, maximum. Variable credit. *Staff*

**195S, 196S. Seminar in Botany. (NS)** Variable credit. *Staff*

**199S. The Changing Biosphere: Past, Present, and Future. (NS)** Prerequisite: consent of instructor. See C-L: Distinguished Professor Course 199S. One course. *Billings*

#### For Seniors and Graduates

**200. Advanced Neuroscience I. (NS)** Prerequisite: Psychology 103. See C-L: Psychology 200; also C-L: Interdisciplinary Course 200. One course. *Cant and McClay*

**201L,S. Animal Behavior. (NS)** Survey of past developments and current controversies in animal behavior. Extensive readings, followed by individual experimental or descriptive projects in the laboratory or field (or Primate Center). Recommended back-

ground: Biology 21L, 22L or Biology 14L; Biology 151L; and Statistics 200; or equivalents. One course. *Klopfer*

**203L. Marine Ecology. (NS)** Application of ecological theory to marine systems. Emphasis on hypothesis formulation, field experimentation, data analysis, scientific writing, and familiarity with current ecological literature. Given at Beaufort. Prerequisite: course in introductory ecology, invertebrate zoology, or marine botany (phycology); knowledge of statistics helpful. C-L: Marine Sciences. One and one-half courses. *Hay (visiting summer faculty)*

**205. Molecular Biology. (NS)** Molecular aspects of gene expression and cell differentiation; application of recombinant DNA techniques to basic and applied problems. Prerequisite: cell biology and/or genetics. One course. *Johnston*

**206S. Controversies in Biology. (NS)** A contentious theme for reading, discussion, and an individual or joint paper. Illustrative past topics: the nature of the creative process, causality in biological thought, the lack of political impact of many scientific developments. Open to nonmajors. One course. *Klopfer*

**210L. Bryology. (NS)** Morphological, systematic, and ecological characteristics of mosses and liverworts. One course. *Mishler*

**212L. Phycology. (NS)** Morphological and ecological characteristics of common freshwater and marine algae and principles of their classification. One course. *Searles*

**216L. Limnology. (NS)** Lakes, ponds, and streams; their origin, development, geochemistry, energy balance, productivity, and the dynamics of plant and animal communities. Laboratory includes field trips. Offered biennially. Prerequisites: Biology 21L, 22L or Biology 14L; and Chemistry 12 and Mathematics 32 and physics; or consent of instructor. One course. *Livingstone*

**218. Barrier Island Ecology. (NS)** Adaptation of plants to barrier island migration and other physical characteristics of the coastal environment. Major emphasis on management of barrier beaches from Maine to Texas and the impact of human interference with natural processes. Field studies. Given at Beaufort. Prerequisite: a course in general ecology. C-L: Forestry and Environmental Studies 218 and Marine Sciences. One and one-half courses. *Staff*

**219L. Benthic Marine Algae. (NS)** Morphology, reproduction, life histories, systematics, and natural history of seaweeds. Lectures, laboratories, and fieldwork in ocean and estuaries. Given at Beaufort. Prerequisite: Biology 21L, 22L or Biology 14L; plant diversity recommended. C-L: Marine Sciences. One course. *Searles*

**220L. Mycology. (NS)** Survey of the major groups of fungi with emphasis on life history and systematics. Field and laboratory exercises. One course. *Vilgalys*

**221S. Topics in Advanced Mycology. (NS)** Current research on fungal evolution, genetics, physiology, and ecology. Prerequisite: Biology 220L. One course. *Vilgalys*

**222L. Entomology. (NS)** The biology of insects: diversity, development, physiology, and ecology. Field trips. Prerequisite: Biology 21L, 22L or Biology 14L. One course. *H. Nijhout*

**226L. Ichthyology. (NS)** Diversity, evolution, natural history, and ecology of fishes. Laboratory includes overnight field trips to marine and freshwater habitats. Prerequisites: Biology 21L, 22L or Biology 14L; and Biology 108L or equivalent. One course. *Lundberg*

**232. Microclimatology. (NS)** C-L: Forestry and Environmental Studies 232. One course. *Knoerr*

**233. Principles of Insect Behavior. (NS)** Processes governing the behavior of animals as illustrated by insects. Neural integration, communication, genetics, ecology, and evolution of individual and social behavior. Invertebrate zoology or entomology recommended. One course. *Rausher*

**234S. Problems in the Philosophy of Biology. (NS)** Prerequisite: consent of instructor. See C-L: Philosophy 234S. One course. *Brandon (philosophy)*

**237L. Systematic Biology. (NS)** Theory and practice of identification, species discovery, phylogeny reconstruction, classification, and nomenclature. Prerequisites: Biology 21L, 22L or Biology 14L; and one course in animal or plant diversity. One course. *Lundberg and Mishler*

**243S. Classification of Angiosperms. (NS)** The characteristics and phylogenetic relationships of large and important families of angiosperms with emphasis upon the systems of Cronquist and Thorne. Prerequisite: Biology 142L or equivalent. One course. *R. Wilbur*

**244. Principles of Immunology. (NS)** An introduction to the molecular and cellular basis of the immune response. Topics include anatomy of the lymphoid system, lymphocyte biology, antigen-antibody interactions, humoral and cellular effector mechanisms, and control of immune responses. Prerequisites: Biology 160 and Chemistry 151 and consent of instructor. C-L: Microbiology and Immunology 244. One course. *Carrington (microbiology and immunology), McClay, and staff*

**245S. Radiation Biology. (NS)** The biological effects of ionizing radiations: classical concepts in the context of recent research papers. Analytical uses of radiation. Prerequisites: Biology 21L, 22L or Biology 14L; Chemistry 11, 12; and Physics 51, 52. One course. *Fluke*

**247S. Photobiology. (NS)** Effects of visible light and of ultraviolet and near ultraviolet radiation in living systems: repair processes, quantum processes, physical optics. Prerequisites: college physics and Biology 21L, 22L or Biology 14L. One course. *Fluke*

**249. Comparative Biomechanics. (NS)** The structure and operation of organisms in relation to the mechanics of solids and fluids, including readings from the primary literature. Not open to students who have taken Biology 149. Prerequisites: Physics 51 and Mathematics 31 or equivalents. One course. *Vogel and Wainwright*

**253. Biophysical Plant Physiology. (NS)** Application of physical principles to such processes as ion transport, water relations, and the interconversion of energy in plant cells. Prerequisites: Biology 152L and Mathematics 32 or equivalent. One course. *Knoerr or Siedow*

**256L, S. Plant Biosystematics. (NS)** Descriptive and experimental procedures used to assess systematic implications of plant evolution. Laboratory, discussion, and field-oriented problems. Prerequisites: basic courses in systematics and genetics. One course. *Vilgalys*

**259L. Laboratory in Biomechanics. (NS)** Introduction to instruments used in investigations of solid and fluid biomechanics. Exercises and individual projects. Prerequisites: Biology 249 and consent of instructor. One course. *Vogel and Wainwright*

**261. Photosynthesis. (NS)** Principles of photosynthesis: developmental, mechanistic, regulatory, and ecological aspects of the photosynthetic process. Prerequisite: Biology 152L. One course. *Siedow*

**262. Biology of Parasitism. (NS)** How parasites, from viruses through vertebrates, have solved the special problems associated with their dependence on other organisms. Emphasis on life cycles, host-parasite interactions, and experimental parasitology. Intended for seniors. Prerequisites: cell biology and animal diversity. One course. *M. Nijhout*



**265L. Physiological Plant Ecology. (NS)** The physiological approach to interpreting adaptation in plants, with emphasis on terrestrial seed plants. Prerequisites: Biology 110L and 152L or equivalents. One course. *Strain*

**266. Plant Population Biology. (NS)** Theoretical, experimental, and field approaches to plant population dynamics; population growth and regulation; effects of density, competition, and predation. One course. *Antonovics*

**267L. Community Ecology. (NS)** Mechanisms that determine the distribution and abundance of plants and animals: geology, climate, physiography, soils, competition, predation, and history. Lectures focus on ecological principles. Seminars and weekend field trips. Prerequisites: an introductory ecology course and consent of instructor. One course. *Christensen and H. Wilbur*

**269. Advanced Cell Biology. (NS)** Structural and functional organization of cells and their components with emphasis on current research problems and prospects. Prerequisite: introductory cell biology or consent of instructor. C-L: Cell and Molecular Biology 269, Cell Biology 269, and Microbiology and Immunology 269. One course. *Nicklas and staff*

**272. Biogeochemistry. (NS)** Processes controlling the circulation of carbon and biochemical elements in natural ecosystems and at the global level, with emphasis on soil and surficial processes. Prerequisite: Chemistry 12 or equivalent. C-L: Geology 272. One course. *Schlesinger*

**274L. Marine Invertebrate Zoology. (NS)** Structures, functions, and habits of invertebrate animals under natural and experimental conditions. Field trips. Not open to students who have taken Biology 76L or 176L. Given at Beaufort. Prerequisite: Biology 21L, 22L or Biology 14L. C-L: Marine Sciences. One and one-half courses. *Ruppert (visiting summer faculty)*

**278L. Invertebrate Developmental Biology. (NS)** Gametogenesis, fertilization, and development of invertebrates, with emphasis on experimental studies of prelarval stages. Given at Beaufort. Prerequisite: consent of instructor. C-L: Marine Sciences. One and one-half courses. *McClay and visiting staff*

**281. DNA, Chromosomes, and Evolution. (NS)** The relationship of chromosome and DNA-sequence organization with evolution; karyotype changes and speciation; repetitive DNA, split genes, transposable elements, and evolutionary mechanisms; phylogeny reconstruction; evolution of mitosis and the chromosome cycle. Prerequisite: an introductory course in genetics or cell or molecular biology, or consent of instructor. C-L: The University Program in Genetics. One course. *Laurie and Nicklas*

**283. Extrachromosomal Inheritance. (NS)** Genetics, biochemistry, and molecular biology of the organelles of eukaryotic cells, and cellular symbionts. Emphasis on recent literature. Prerequisite: introductory genetics. C-L: The University Program in Genetics. One course. *Boynton and Gillham*

**285S. Ecological Genetics. (NS)** Interaction of genetics and ecology and its importance in explaining the evolution, diversity, and distribution of plants and animals. Prerequisites: Biology 180 and 286 or equivalents. C-L: The University Program in Genetics. One course. *Antonovics*

**286. Evolutionary Mechanisms. (NS)** Population ecology and population genetics of plants and animals. Fitness concepts, life history evolution, mating systems, genetic divergence, and causes and maintenance of genetic diversity. Prerequisite: Biology 21L, 22L or Biology 14L with either plant or animal diversity; Biology 180. C-L: The University Program in Genetics. One course. *Antonovics, Uyenoyama, and H. Wilbur*

**287S. Macroevolution. (NS)** Evolutionary patterns and processes at and above the species level; species concepts, speciation, diversification, extinction, ontogeny and phylogeny, rates of evolution, and alternative explanations for adaptation and evolutionary trends. Prerequisite: Biology 21L, 22L or Biology 14L with one course in plant or animal diversity. C-L: One course. *Mishler and Roth (zoology)*

**288. Mathematical Population Genetics. (NS)** Principles of formulation and analysis of dynamic mathematical models of genetic evolution. Rotating topics include: mating systems, sex ratio, stochastic processes. Prerequisites: calculus; statistics and linear algebra recommended. C-L: The University Program in Genetics. One course. *Uyenoyama*

**293L. Population Biology. (NS)** Theoretical approach to population genetics, life table mathematics, life-cycle evolution in plants and animals, population dynamics, and regulation. Laboratories emphasize experimental methods. Individual projects and weekend field trips. Prerequisites: calculus and ecology. One course. *Antonovics and H. Wilbur*

**295S, 296S. Seminar. (NS)** Variable credit. *Staff*

### Courses Currently Unscheduled

**51L. Culture and Propagation of Plants. (NS)**

**107. Heredity. (NS)**

**178. Functional Morphology. (NS)**

**179T. Tutorial in Functional Morphology. (NS)**

**209L. Lichenology. (NS)**

**263L. Tropical Seaweeds. (NS)**

### THE MAJOR

The Bachelor of Arts and the Bachelor of Science degrees are offered with a major in biology or in an individually designed interdepartmental concentration approved by the Director of Undergraduate Studies in Biology. Information about the biology major may be obtained in the office of the Director of Undergraduate Studies.

### For the A. B. Degree

This degree program is the general liberal arts major program. Students contemplating a career in biological or biomedical sciences should elect the program leading to the B.S. degree.

*Prerequisite.* Biology 21L, 22L or equivalent.

*Corequisites.* Chemistry 11, 12; Mathematics 31, 32; plus three science-related courses outside the biological sciences selected from an approved list of such courses.

*Major Requirements.* A minimum of eight courses in the biosciences, not including the above prerequisites and corequisites; two of these courses must include related laboratory experience; one laboratory independent study course may be counted toward the laboratory requirement. The eight courses must include one core course from each of three areas: cell biology and genetics; organism structure and function; and ecology, evolution, and systematics. These courses are prerequisites to many of the advanced courses in these subject areas. The remaining courses may be elected from among courses numbered 100 or above in biology, or from approved courses in the basic science departments of the School of Medicine, or from approved courses of a basic biological character in related departments. For a straight biology major, five of these eight courses must be in biology. The elective courses acceptable for a biology major with an area of concentration are defined by the requirements for that concentration. At least one of these eight courses must be at the 200 level.

## For the B.S. Degree

This is the program in biology for students contemplating a career in biological or biomedical sciences.

*Prerequisite.* Biology 21L, 22L or equivalent.

*Corequisites.* Mathematics 31, 32; Chemistry 11, 12, and 151; Physics 51 and 52. Additional corequisites may be required for particular areas of concentration (see below).

*Major Requirements.* A minimum of eight courses in the biosciences, not including the above prerequisites and corequisites; two of these courses must include related laboratory experience; one laboratory independent study course may be counted toward the laboratory requirement. The eight courses must include one core course from each of three areas: cell biology and genetics; organism structure and function; and ecology, evolution, and systematics. These courses are prerequisites to many of the advanced courses in these subject areas. The remaining courses may be elected from among courses numbered 100 or above in biology, or from approved courses in the basic science departments of the School of Medicine, or from approved courses of a basic biological character in related departments. For a straight biology major, five of these eight courses must be in biology. The elective courses acceptable for a biology major with an area of concentration are defined by the requirements for that concentration. At least one of these eight courses must be at the 200 level.

## For Areas of Concentration

Students may elect to complete requirements in specified areas of concentration. Certification in an area of concentration is designated on the official transcript. For information on areas of concentration see the Director of Undergraduate Studies.

## The Negotiated Major

As an alternative to the above programs, a student with unusual interests in biology may arrange a negotiated concentration of study. After appropriate discussion with departmental faculty, a student may devise a program of study which must be endorsed by two members of the faculty and approved by the Director of Undergraduate Studies. The statement of the proposed program must make clear why the negotiated major is more appropriate than a conventional major. Such a program must be arranged before the start of a student's fifth semester. The only formal limitation on this approach to the major is that it include at least five courses in biology to meet minimum Trinity College requirements. See the *Handbook for Biology Majors* for more details.

## Honors

A program for graduation with distinction in biology is available. See the section on honors in this bulletin. The Director of Undergraduate Studies can provide more details.

## Botany (BOT)

Professor W. Culberson, *Chairman*; Professors Antonovics, Boynton, Christensen, Osmond, Ramus, Schlesinger, Searles, Siedow, Stone, Strain, White, and R. Wilbur; Associate Professor Knoerr; Assistant Professors Johnston, Kohorn, Mishler, and Vilgalys; Professors Emeriti Anderson, Billings, Hellmers, Kramer, Naylor, and Philpott; Adjunct Professor C. Culberson; Adjunct Associate Professor Patterson

See Biology for a description of the major and the list of courses taught by the botany faculty.

## Canadian Studies Program

Professor Cahow, *Director*

A second major is available in this program.



The program in Canadian studies seeks to provide the student with an understanding of Canada and its problems and prospects. Students may undertake the program to supplement another major, or to complete a second major in Canadian studies, or as part of an interdepartmental concentration, or under Program II. Canadian studies may also be an area concentration in the comparative area studies major, described elsewhere in this bulletin. See sections below on the program and the major. The courses are described in the departmental and interdisciplinary listings.

## COURSES WITH FULL CANADIAN CONTENT

The following courses count as one full course in the four required for the program in Canadian studies and in the eight required for the major in Canadian studies:

### Drama

146S. Canadian Theater. *Ball*

### English

186. Canadian Literature in English. *Staff*

### French

114. Language and Civilization of Quebec. *Staff*

169. The Contemporary Novel in French Canada. *Keinig and staff*

### History

183S. Canada from the French Settlement. *Cahow*

### Interdisciplinary Courses

184. An Introduction to Canada and Canadian Issues. See C-L: Interdisciplinary Course 184; also C-L: Comparative Area Studies, Economics 184, History 184, Political Science 184, and Sociology 184. *Cahow*  
282S. Canada. See C-L: History 282S; also C-L: Comparative Area Studies, Cultural Anthropology 282S, History 282S, Interdisciplinary Course 282S, Political Science 282S, and Sociology 282S. *Cahow*

## COURSES WITH SIGNIFICANT CANADIAN CONTENT

Two of these partial content courses may count as one full course among the four required for the program in Canadian studies and among the eight required for the major in Canadian studies, but no more than two partial content courses may be counted as full content courses in this way. All other partial content courses may count only for a half credit for Canadian studies majors and programs.

### Economics

265S. International Trade and Finance. By special arrangement this course may be counted as a full content course. *Tower*

### French

131S. French in the New World. *Hull*

### Health Administration

Students interested in this area should consult the Director of the Canadian Studies Program (2016 Campus Drive) for more information.

### History

150. Canadian and American Agrarian Movements. *Goodwyn*

166S. U.S. and Canada: Canadian-American Relations. *Staff*

167S. United States and Canadian Constitutional Issues. *Cahow*

215-216. The Diplomatic History of the United States. *C. Davis*

### Interdisciplinary Courses

182. Media in Comparative Perspective. *Paletz or Smith*

### Political Science

175. Political Parties and Legislatures in Western Democracies. *Kornberg*

180. Media in Comparative Perspective. *Paletz or Smith*

195. Comparative Political Behavior in the United States and Canada. *Kornberg*

293. Federalism. *Leach*

### Sociology

170. Mass Communication. *Smith*

## THE PROGRAM

In the Canadian Studies Program a student must take four courses with Canadian content or their equivalents. These must include Interdisciplinary Course 184. It is recommended that students who do not have the equivalent of two years of college level French should take French 181 and 182, Intensive French.

## THE MAJOR

*Corequisite.* Completion of another major.

*Major Requirements.* Eight courses in Canadian studies, including Interdisciplinary Course 184 and seven other semester-course credits in courses on Canada with full or significant content, or approved independent study, or special reading courses. Two of the courses with significant Canadian content may count as half courses to make up the eight required courses. No more than two courses required for the first major may be counted for the Canadian studies major.

To complete the major in Canadian studies a student must also take at least two full years of college level French, or must possess an equivalent competence in the language as certified by the Department of Romance Languages.

## Chemistry (CHM)

Professor Arnett, *Chairman*; Professor Wilder, *Director of Undergraduate Studies*; Professor Bonk, *Supervisor of Freshman Instruction*; Professors Baldwin, Chesnut, Crumbliss, Fraser-Reid, Lochmüller, A. McPhail, Palmer, Porter, Smith, Strobel, and Wells; Associate Professors Henkens, McGown, and Shaw; Assistant Professors R. MacPhail, Polniaszek, and Prisant; Professors Emeriti Bradsher, Brown, Hobbs, Krigbaum, Poirier, and Quin; Adjunct Professors Ghirardelli, Jeffs, Painter, Pitt, Preston, and Spielvogel; Adjunct Associate Professors Morosoff and Millington; Adjunct Assistant Professors Chao and Sternbach

A major is available in this department.

Courses with laboratories include fifty to sixty hours of laboratory work per term.

**11, 12. Principles of Chemistry. (NS)** The introductory course for students who intend to take additional chemistry courses other than Chemistry 83. 11: emphasizes stoichiometry and atomic and molecular structures. 12: emphasizes thermodynamics, chemical kinetics, synthesis, and analysis. Laboratory work includes both qualitative and quantitative analysis. Prerequisites: one year of high school chemistry or consent of instructor; Mathematics 19 or its equivalent; and for 12: Chemistry 11. One course each. *Bonk and staff*

**23. Advanced General Chemistry. (NS)** An intensive introductory course for well prepared students, covering in one semester the major topics of Chemistry 11 and 12. Laboratory work includes both qualitative and quantitative analysis. Students may not receive credit for both Chemistry 23 and Chemistry 11, 12 or Chemistry 31S. Prerequisites: Mathematics 19 or its equivalent; and two years of high school chemistry or consent of instructor. One course. *Bonk and staff*

**31S. Advanced Chemical Fundamentals. (NS)** Generally paralleling Chemistry 23, but for selected able potential science majors. Taught as one lecture and two discussions weekly. Laboratory with a month of small research problems. Prerequisite: consent of instructor. One course. *R. MacPhail or Strobel*

**49S. Freshman Seminar.** Topics vary each semester offered. One course. *Staff*

**83. Chemistry and Society. (NS)** Past discoveries and current challenges: a chemical background for decisions involving energy, radiation, pollution, drugs, food additives, vitamins, and pesticides. For students not majoring in a natural science or continuing in chemistry. Not open to students having credit for Chemistry 11 or equivalent. One course. *Wells and staff*

**117. Inorganic Chemistry. (NS)** Bonding, structures, and reactions of inorganic compounds studied through physical chemical concepts. Prerequisite: Chemistry 161. One course. *Crumbliss, Palmer, or Wells*

**132. Analytical Chemistry. (NS)** Fundamentals of qualitative and quantitative measurement with emphasis on instrumental methods of analysis. Laboratory. Prerequisite: Chemistry 161. One course. *Lochmüller, McGown, or Strobel*

**151, 152. Organic Chemistry. (NS)** The structures and reactions of the compounds of carbon. Laboratory: techniques of separation, organic reactions and preparations, and systematic identification of compounds by their spectral and chemical properties. Prerequisite: Chemistry 12, 23, or 31S or consent of Director of Undergraduate Studies; for 152: Chemistry 151. One course each. *Baldwin, Fraser-Reid, Polniaszek, Porter, or Wilder*

**154. Intermediate Organic Chemistry: Mechanism and Stereochemistry of Synthetic Organic Reactions. (NS)** A mechanism-based survey of enolate chemistry, sigmatropic rearrangements, polyene cyclizations, hydroboration, oxidation and reduction methods. Laboratory work emphasizes techniques involved in manipulation of sensitive reagents and analysis of reaction products. Prerequisite: Chemistry 152. One course. *Polniaszek*

**161. Physical Chemistry. (NS)** Fundamentals of theoretical chemistry with particular emphasis on chemical thermodynamics and kinetics. Laboratory. Prerequisites: Chemistry 152, Physics 52 and Mathematics 32 or 34. One course. *Chesnut, Henkens, R. MacPhail, Prisant, or Smith*

**162. Physical Chemistry. (NS)** Fundamentals of theoretical chemistry with particular emphasis on quantum chemistry, molecular structure, and molecular spectroscopy. Laboratory. Prerequisites: Chemistry 161 and either Mathematics 103 or 105 or consent of instructor. One course. *Chesnut, R. MacPhail, Prisant, or Smith*

**176. Biophysical Chemistry. (NS)** The physical chemical principles of and experimental methods employed in the study of biological macromolecules. Students may not receive credit for both Chemistry 176 and 196S. Prerequisites: Chemistry 161 and 175 or Biochemistry 227. One course. *Henkens*

**191, 192. Independent Study. (NS)** Supervised reading and research. Prerequisite: consent of Independent Study Coordinator. One course each. *Staff*

**193, 194. Independent Study. (NS)** Supervised reading and research. Prerequisites: Chemistry 191, 192, and consent of Independent Study Coordinator. One course each. *Staff*

**195S, 198S. Seminar. (NS)** Topics from various areas of chemistry, changing each year. For example: organic chemistry of biologically important compounds, chemical basis of pharmacology, metal ions in biological systems. Open to senior chemistry majors or by consent of instructor. One course each. *Staff*

**196S. Seminar. (NS)** Selected topics in physical chemistry of biological macromolecules. Students may not receive credit for both Chemistry 176 and 196S. Prerequisites: Chemistry 161 and 175 or Biochemistry 227. One course. *Henkens or Shaw*

### For Seniors and Graduates

**201. Molecular Spectroscopy. (NS)** Selected spectroscopic methods in the study of molecular structure. Symmetry and group theoretical basis for selection rules, theories



of magnetic and optical resonance, and interpretation of spectra; examples from both inorganic and organic chemistry. Three lectures. Prerequisite: consent of Director of Undergraduate Studies. One course. *Fraser-Reid, Palmer, and Smith*

**203. Quantum Chemistry. (NS)** Basic principles of quantum and group theoretical methods. Topics include symmetry and a review of the fundamentals and the mathematical foundations of quantum theory. Emphasis on the application of molecular orbital theory to organic and inorganic systems. Prerequisites: Chemistry 162 and consent of Director of Undergraduate Studies. One course. *Chesnut and Polniaszek*

**205. Structure and Reaction Dynamics. (NS)** Structure and mechanisms in organic and inorganic compounds, substitution reactions, linear free energy relations, and molecular rearrangements. Emphasis on the use of kinetic techniques to solve problems in reaction mechanisms. Three lectures. Prerequisite: consent of Director of Undergraduate Studies. One course. *Arnett, Crumbliss, and Polniaszek*

**207. Principles of Kinetics, Thermodynamics, and Diffraction. (NS)** Three lectures. Prerequisite: consent of Director of Undergraduate Studies. One course. *Staff*

**209. Advanced Chemistry. (NS)** A combination of three one-third course segments from Chemistry 201, 203, 205, and 207. Interested students should consult the Director of Undergraduate Studies for scheduling. Prerequisite: consent of Director of Undergraduate Studies. One course. *Staff*

**275, 276. Advanced Studies. (NS)** (1) Analytical chemistry, (2) inorganic chemistry, (3) organic chemistry, and (4) physical chemistry. Open to especially well-prepared undergraduates by consent of Director of Undergraduate Studies. One course each. *Staff*

#### COURSES CURRENTLY UNSCHEDULED

151M, 152M. Organic Chemistry. (NS)

152P. Preceptorial. (NS)

175. Molecular Basis of Biological Processes. (NS)

197S. Seminar. (NS)

#### THE MAJOR

Differing major programs are offered under the baccalaureate degrees. The Bachelor of Arts degree programs permit greater flexibility in allowing students to select an area of concentration while satisfying the junior-senior small group learning experience requirements through seminar courses (option one) or through independent study in chemistry or related departments (option two). Of particular significance are the areas of specialization including marine chemistry, chemical physics, materials science, and biological chemistry. Students may specialize in biological chemistry using either seminars (option three) or independent study in chemistry or related departments (option four) to satisfy the junior-senior small group learning experience requirement. The Bachelor of Science degree program, accredited by the American Chemical Society, provides in-depth preparation for graduate study in chemistry.

#### For the A.B. Degree

*Prerequisites.* Chemistry 11, 12; or Chemistry 23 or 31S; or advanced placement. Mathematics 31, 32 (or 33, 34); Physics 51, 52.

*Major Requirements.* Chemistry 132, 151, 152, 161, plus one of the following options:

1. Two of the following: Chemistry 117, 154, 162, 175 (or Biochemistry 227), 176, 195S, 196S, 198S.

2. One of the following: Chemistry 117, 154, 162, 175 or Biochemistry 227; *plus* Chemistry 191, 192 or the equivalent in a natural science, mathematics, engineering, or a basic science department in the School of Medicine.
3. Chemistry 175 or Biochemistry 227; 195S or 198S; and 176 or 196S.
4. Chemistry 175 or Biochemistry 227 and Chemistry 176 or 196S; and Chemistry 191, 192 in a biochemically related area, or the equivalent in a biological area, biomedical engineering, or basic science department in the School of Medicine.

*Recommendations.* Computer Science 51 or Engineering 51, Mathematics 103 or 105 (for options one and two); Chemistry 162; two courses in a foreign language or the equivalent. Students planning graduate study are advised to take these recommended courses and to consult with advisors regarding appropriate additional courses.

### **For the B.S. Degree**

*Prerequisites.* Chemistry 11, 12; or Chemistry 23 or 31S; or advanced placement. Mathematics 31, 32 (or 33, 34); 103 (or 105); Physics 51, 52; two courses in German or Russian or the equivalent.

*Major Requirements.* Chemistry 117, 132, 151, 152, 161, 162, plus four of the following courses: Chemistry 154, 175 (or Biochemistry 227), 176, 191, 192, 195S, 196S, 198S, 201, 203, 205, 207, 209, 275, or 276, with at least two being selected from the laboratory courses 154, 191, 192. In an exceptional case and with the prior approval of the Director of Undergraduate Studies, a student may substitute one advanced level nonindependent study course, or a two-course independent study sequence, in an appropriate science department in Trinity College, the School of Engineering, or the School of Medicine for one of the two optional nonlaboratory chemistry courses. At least nine courses above the freshman sequence must be completed in chemistry. A course directly paralleling one offered by the chemistry department may not be substituted. Chemistry 201, 203, 205, and 207 are offered also in one-third semester segments; in some instances a student may wish to take some combination of three of these segments by registering for Chemistry 209. Additional details may be obtained from the Director of Undergraduate Studies.

*Recommendations.* Computer Science 51 or Engineering 51; Mathematics 104; Physics 100. Students planning graduate study in chemistry should consult with advisors regarding appropriate additional courses.

### **Honors**

The department offers a program for graduation with distinction in chemistry. See the section on honors in this bulletin. The program involves two semesters of independent study, taken either in the chemistry department (Chemistry 191, 192) or, with the prior approval of the Coordinator of Independent Study, in an appropriate science department in Trinity College, the School of Engineering, or the School of Medicine. A research paper based upon the independent study and nomination by the research supervisor form the basis for consideration by a departmental committee. The committee may recommend the student for graduation with distinction in chemistry. Additional details may be obtained from the Director of Undergraduate Studies.

## **Chinese**

For courses in Chinese, see Asian and African Languages.

## **Classical Studies (CS)**

Professor Newton, *Chairman*; Associate Professor Boatwright, *Director of Undergraduate Studies*; Professors Oates and Richardson; Associate Professors Burian, Rigsby, Stanley, and Younger; Assistant Professor Vander Waerdt; Professor Emeritus Willis; Adjunct Professor Michels

Majors are available in this department.

The objective of classical studies is to increase knowledge and understanding of the roots of Western culture in the civilizations of Greece and Rome. Toward this aim, the department offers courses and majors in three areas: Latin, Greek, and classical studies. Concentration in the languages offers students training in exploring at first hand the literature, history, and thought of antiquity. In the process, students will gain a deeper insight into language itself, as well as an appreciation of the problems of interpretation and the varieties of evidence upon which interpretation may be based. For students interested in history, ancient art, or archaeology, courses in classical studies offer a means of assessing the culture and the material remains of Greece and Rome in their own rich and varied context.

A secondary aim is, and has been by a centuries-old tradition, the development of a keener perception and understanding of the cultural forces at work in the contemporary world. As a result, the field of classical studies is an excellent foundation for advanced work in other academic disciplines as well as professional programs in law, medicine, and finance.

## GREEK (GRK)

**1-2. Elementary Greek. (FL)** A study of grammar and an introduction to reading. Two courses. *Burian*

**11-12. Elementary Modern Greek. (FL)** An introduction to literary and conversational demotic Greek. Two courses. *Younger*

**63, 64. Intermediate Greek. (FL)** Introduction to Greek prose and poetry. 63: Plato's *Republic I, Apology, or Symposium*. 64: Euripides and Homer. One course each. *Vander Waerdt or Younger*

**103S, 104S. Studies in Greek Literature. (AL, FL)** 103S: Herodotus and Sophocles. 104S: Thucydides and Aristophanes. One course each. *Burian or Vander Waerdt*

**181S. Intensive Elementary Greek. (FL)** Intensive introduction to the language and the literature, offered only in the summer. Prerequisite: proficiency in another language. Two courses. *Staff*

**182S. Intensive Intermediate Greek. (FL)** See Greek 181S. Prerequisites: Greek 181S and proficiency in another language. Two courses. *Staff*

**200. Readings in Greek Literature. (AL)** One course. *Staff*

**203. Homer. (AL, FL)** Problems of language and structure in the *Iliad*; present state of Homeric scholarship. One course. *Stanley*

**205. Greek Lyric Poets. (AL, FL)** Fragments of the early lyric poets; selected odes of Pindar and Bacchylides. One course. *Burian or Stanley*

**207. The Dramatists. (AL, FL)** Readings and studies of selected plays by the major playwrights Aeschylus, Sophocles, Euripides, and Aristophanes. One course. *Burian*

**210. Hellenistic Literature. (AL, FL)** Examples of Hellenistic literature with emphasis on the *Argonautica* of Apollonius of Rhodes, and attention to the shorter poems of Theocritus and Callimachus. One course. *Stanley*

**217T. Greek Prose Composition. (FL)** The course content is determined by the needs of the students enrolled. One course. *Staff*

**222. The Historians. (AL, FL)** Readings and studies in the major Greek historians Herodotus, Thucydides, and Xenophon. One course. *Oates*



*Courses offered each year on demand in consultation with the Director of Undergraduate Studies:*

**191, 192. Independent Study.** Directed reading and research. Open only to qualified juniors and seniors. One course each. *Staff*

**193, 194. Directed Research in Greek.** Research culminating in the writing of one longer or two shorter papers as partial fulfillment of the requirements for graduation with distinction. Open only to senior majors. One course each. *Staff*

## LATIN (LAT)

**1-2. Elementary Latin. (FL)** Study of the structure of the language (forms, vocabulary, syntax, and pronunciation); selected readings in prose and poetry. Two courses. *Stanley*

**63, 64. Intermediate Latin. (FL)** Introduction to Latin prose and poetry. 63: selected prose, including Caesar. 64: three books of Vergil's *Aeneid*. One course each. *Boatwright*

**100. Introduction to Literature.** This number represents course credit for a score of 4 or 5 on one or more of the College Board Advanced Placement tests in Latin. One course.

**103S, 104S. Studies in Latin Literature. (AL, FL)** 103S: the Late Republic, including Catullus and Cicero. 104S: the Age of Augustus, including Horace and Livy. One course each. *Boatwright or Newton*

**105S. Ovid: The Metamorphoses. (AL, FL)** The poem studied as representative of Ovid's varied narrative art, as the largest-scale Roman treatment of classical myths, and in the light of the distinctively Ovidian attitude toward Augustanism. One course. *Newton*

**108S. Lyric and Occasional Poetry. (AL, FL)** Readings in the works of Catullus, Horace, and Martial. One course. *Newton or Richardson*

**111S. Elegiac Poets. (AL, FL)** The traditions of Latin love elegy and its development in Propertius, Tibullus, and Ovid. One course. *Richardson*

**112S. Roman Comedy. (AL, FL)** Representative plays of Plautus and Terence with lectures on the genre and its Greek forebears. One course. *Richardson*

**114S. The Historians. (AL, FL)** Readings in representative historical writing chosen from Caesar, Sallust, Livy, and Tacitus. One course. *Boatwright or Richardson*

**116S. Lucretius. (AL, FL)** The *De Rerum Natura* studied as poetry and philosophical thought. One course. *Newton or Richardson*

**181S. Intensive Elementary Latin. (FL)** Intensive introduction to the language and the literature, offered only in the summer. Prerequisite: proficiency in another language. Two courses. *Staff*

**182S. Intensive Intermediate Latin. (FL)** See Latin 181S. Prerequisites: Latin 181S and proficiency in another language. Two courses. *Staff*

**200. Readings in Latin Literature. (AL)** One course. *Staff*

**206. Cicero. (AL, FL)** One course. *Richardson*

**207S. Vergil's *Aeneid*. (AL, FL)** Intensive analysis of all of Vergil's *Aeneid*, focusing on text and historical context, complemented by research papers and reports. Not open to students who have taken Latin 107S. One course. *Newton*

**211S. Elegiac Poets. (AL, FL)** Analysis of most of the *corpora* of Propertius, Tibullus, and Ovid with close attention to the stylistics of the poems, their place in the traditions

of Latin love elegy, and their relation to other phenomena of the Augustan period. Not open to students who have taken Latin 111S. One course. *Richardson*

**214S. The Historians. (AL, FL)** Investigations of the Romans' conceptions and practices of writing history, based on detailed analysis of the works of Sallust, Livy, and Tacitus. Additional readings in the fragments of other Latin historians, and in comparative Greek historians. Not open to students who have taken Latin 114S. One course. *Boatwright or Richardson*

**217T. Latin Prose Composition. (FL)** The course content is determined by the needs of the students enrolled. One course. *Staff*

**221. Medieval Latin. (AL, FL)** Selected works of the Latin Middle Ages from Prudentius to the humanists. Genres studied usually include the hymn, sequence, drama, lyric, saints' lives, chronicle, epic, and epistle. C-L: Medieval and Renaissance Studies. One course. *Newton*

*Courses offered each year on demand in consultation with the Director of Undergraduate Studies:*

**191, 192. Independent Study.** Directed reading and research. Open to qualified juniors and seniors. One course each. *Staff*

**193, 194. Directed Research in Latin.** Research culminating in the writing of one longer or two shorter papers as partial fulfillment of the requirements for graduation with distinction. Open only to senior majors. One course each. *Staff*

#### Courses Currently Unscheduled

**106S. Roman Satire. (AL, FL)**

**107S. Vergil's *Aeneid*. (AL, FL)**

**204. Epic of the Silver Age. (AL, FL)**

**205. The Roman Novel. (AL, FL)**

**208S. Lyric and Occasional Poetry. (AL, FL)**

#### CLASSICAL STUDIES (CS)

**11S. Greek Civilization. (CZ)** The culture of the ancient Greeks from the Bronze Age to Alexander the Great: art, literature, history, philosophy, and religion. Not open to students who have had Classical Studies 53 or History 53. One course. *Staff*

**12S. Roman Civilization. (CZ)** The culture of ancient Romans from their beginnings to Constantine: art, literature, history, philosophy, and religion. Not open to students who have had Classical Studies 54 or History 54. One course. *Staff*

**49S. Freshman Seminar.** Topics vary each semester offered. One course. *Staff*

**53. Greek History. (CZ)** The political and intellectual history of the Hellenes from earliest times to the death of Alexander the Great. Not open to students who have had Classical Studies 11S. C-L: History 53. One course. *Rigsby*

**54. Roman History. (CZ)** The Roman Republic and Empire to the Late Antique. Not open to students who have had Classical Studies 12S. C-L: History 54. One course. *Boatwright*

**63. The Epic. (AL)** Reading in translation of major epics from antiquity and the Middle Ages, such as *Gilgamesh*, Homer's *Iliad* and *Odyssey*, Vergil's *Aeneid*, and *Beowulf*. One course. *Burian*

- 64. Drama of Greece and Rome. (AL)** Reading in translation of Greek and Roman tragedies (Aeschylus, Sophocles, Euripides, Seneca) and comedies (Aristophanes, Menander, Plautus, Terence). C-L: Drama 64. One course. *Burian*
- 93. History of Ancient Philosophy. (CZ)** Prerequisites: for freshmen, previous philosophy course and consent of instructor. See C-L: Philosophy 93. One course. *Ferejohn or Mahoney*
- 101. Science and Technology in the Ancient World. (CZ)** Technical innovation and scientific thought in the ancient Near East, Greece, and Rome. C-L: History 100. One course. *Rigsby*
- 102. History of Greek and Roman Civil Law. (CZ)** The development of law from the early Greek *polis* and Rome of the XII tables to the *Digest* of Justinian, emphasizing civil law and procedure. C-L: History 103. One course. *Oates*
- 103. Religion in Greece and Rome. (CZ)** Religious thought, rituals, and institutions from Homer to late antiquity, excluding Christianity. C-L: History 125. One course. *Boatwright or Rigsby*
- 104. Women in the Ancient World. (CZ)** The perception and reality of the roles, functions, and status of women from the time of Homer to late antiquity. C-L: History 126 and Women's Studies. One course. *Boatwright*
- 114D. Hellenistic Philosophy. (CZ)** Prerequisite: sophomore standing; Philosophy 93 suggested. See C-L: Philosophy 114D. One course. *Vander Waerdt*
- 115. The Classical Tradition. (AL)** The notion of the "classical" from the creation of the archetype to the present. One course. *Burian*
- 117. Ancient Mythographers. (AL)** Myth in classical and medieval writers from Hesiod to Boccaccio. C-L: Medieval and Renaissance Studies. One course. *Newton*
- 121. The Art of Ancient Italy. (AL)** See C-L: Art 121. One course. *Castriota*
- 122. Art and Myth in Ancient Greece. (AL)** See C-L: Art 122. One course. *Castriota*
- 123. Greek Art and Archaeology I. (AL)** Greek architecture, sculpture, and painting from the Bronze Age through the Classical period. C-L: Art 123. One course. *Younger*
- 124. Greek Art and Archaeology II. (AL)** Architecture, sculpture, painting, and mosaics from the Classical period through the Greco-Roman period. C-L: Art 124. One course. *Younger*
- 125. The City in Antiquity. (CZ)** See C-L: Art 125. One course. *Castriota*
- 128. Art of the Roman Empire. (AL)** See C-L: Art 128. One course. *Castriota*
- 131. Byzantine Art and Architecture. (AL)** See C-L: Art 131. One course. *Wharton*
- 135. Alexander the Great. (CZ)** His career and the effects of his conquests. C-L: History 181. One course. *Oates*
- 145. Rome: History of the City. (CZ)** The development of the urban plan and its major monuments through the ages; the influence of the ancient Republic and Empire, the Papacy, and the modern secular state; change and continuity in artistic forms and daily life. Taught on site in Italy in summer. C-L: Art 126. One course. *Boatwright or Burian*
- 147. Ancient Greece. (CZ)** On-site study of the cultures in Greece from Neolithic to Medieval, concentrating on Athens, the Peloponnese, Crete, and the Cyclades. Summer program in Greece. Prerequisite: Classical Studies 11S, 53, 123, or 124, or History 53, or consent of instructor. C-L: Art 115. One course. *Younger*



**155. The Aegean Bronze Age. (CZ)** Application of archaeological techniques and procedures to problems in the development of the Minoan and Mycenaean civilizations. C-L: Art 114. One course. *Younger*

**161S. Athens. (CZ)** The city from antiquity (c. 1500 B.C.) to the present, concentrating on its monuments, self-image, and influence. C-L: Art 116S. One course. *Younger*

**162. Pompeii. (CZ)** Contributions of the city to knowledge of ancient Roman life: its history, houses and temples, amusements, and municipal administration. C-L: Art 117. One course. *Richardson*

**171. Ancient Cosmology. (CZ)** The development of Greek theories of cosmology from Thales through the Stoics. Readings from the pre-Socratics, Plato, Aristotle, the Atomists, and the Stoics. Prerequisite: open to sophomores by consent of instructor; Philosophy 93 suggested. One course. *Vander Waerdt*

**173. Classical Political Philosophy. (CZ)** Ancient theories of the way of life and the political regime best suited to promote happiness in human communities. Readings from the Greek sophists, Aristophanes, Plato, Aristotle, the academic skeptics, Stoics, and Cicero. Prerequisite: junior standing; open to sophomores by consent of instructor. C-L: Philosophy 173. One course. *Vander Waerdt*

**191, 192. Independent Study.** Directed reading and research. Open only to qualified juniors and seniors. One course each. *Staff*

**193, 194. Directed Research in Classical Studies.** Research culminating in the writing of one longer or two shorter papers as partial fulfillment of the requirements for graduation with distinction. Open only to senior majors. One course each. *Staff*

**195S, 196S. Junior-Senior Seminars in Classical Studies. (CZ)** Specific aspects of the history, art, and literature of classical Greece and Rome. Open only to qualified juniors and seniors; some knowledge of classical studies and history desirable, but not strictly necessary. Topics have included: sexual roles in antiquity, and Imperial Rome. One course each. *Staff*

**211S. Plato. (CZ)** Selected dialogues. C-L: Philosophy 211S. One course. *Ferejohn*

**217S. Aristotle. (CZ)** Selected topics. C-L: Philosophy 217S. One course. *Ferejohn*

**220S. Studies in Greek Art. (AL)** Prerequisite: consent of instructor. See C-L: Art 220S. One course. *Castriota*

**222. Fifth and Fourth Century Greece. (CZ)** From the Persian Wars to the dominance of Philip of Macedon. C-L: History 260. One course. *Oates or Rigsby*

**223. Alexander and the Hellenistic World. (CZ)** The achievements and legacy of Alexander the Great and the rise of Roman power in the Eastern Mediterranean. C-L: History 261. One course. *Oates*

**224. The Roman Republic. (CZ)** The rise of Rome, to its mastery of the Mediterranean; the political, social, and intellectual consequences. C-L: History 263. One course. *Boatwright or Rigsby*

**225. The Roman Empire. (CZ)** The foundation, consolidation, and transformation of Roman rule from Augustus to Diocletian. C-L: History 264. One course. *Boatwright*

**227S. Studies in Roman Art. (AL)** Prerequisite: consent of instructor. See C-L: Art 221S. One course. *Castriota*

**230S. Medieval and Byzantine Art and Architecture. (AL)** Prerequisite: consent of instructor. See C-L: Art 230S; also C-L: Medieval and Renaissance Studies. One course. *Wharton*

**231S. Greek Sculpture. (AL)** Free standing, relief, and architectural sculpture from the archaic period to the Hellenistic Age, representing changing aesthetic, social, and political aims. C-L: Art 222S. One course. *Stanley*

**232S. Greek Painting. (AL)** From the late Bronze Age to the fourth century B.C., with emphasis on archaic and classical Athenian vase painters. C-L: Art 223S. One course. *Stanley*

**235S. Roman Architecture. (AL)** Development of design and engineering in the architecture of ancient Rome. The major building forms, public and private, and the principal styles from the regal period to Hadrian. C-L: Art 225S. One course. *Richardson*

**236S. Roman Painting. (AL)** The techniques, iconography, and use in decoration. C-L: Art 226S. One course. *Richardson*

**258. The Hellenistic and Roman East. (CZ)** The social and cultural history of the Greco-Roman world, concentrating on papyrological evidence. Prerequisites: knowledge of ancient Greek and Latin. One course. *Oates*

### Courses Currently Unscheduled

129. The Age of Justinian. (AL)

221. Archaic Greece. (CZ)

226. Late Antiquity. (CZ)

233S. Greek Architecture. (AL)

### THE MAJOR

Students may choose first or second majors in Greek, Latin, or in classical studies (ancient history, civilization, or archaeology).

Students majoring in either Greek or Latin who contemplate graduate work are reminded of the necessity for competence in both languages and a reading knowledge of French and German for all higher degrees.

Prospective second majors in Latin, Greek, or classical studies are urged to consult with the Director of Undergraduate Studies at the earliest feasible time, preferably by the sophomore year.

Majors are eligible for nomination to one semester during their junior year at the Intercollegiate Center for Classical Studies in Rome, of which Duke University is a founding member, or at the College Year in Athens, at a cost comparable to that of a semester at Duke. Financial assistance at Duke can usually be transferred, and arrangements are made through the University. Courses in Greek, Latin, ancient history, and archaeology taken in these programs are counted toward the major requirements. For further information, see the section on study abroad.

### Greek

*Prerequisite.* Greek 2 or equivalent.

*Major Requirements.* Six courses in Greek above the level of Greek 12, and Classical Studies 195S or 196S. In addition, students will be required to pass an examination testing proficiency in Greek composition or to complete Greek 117T. Students entering with three or more years of ancient Greek are urged to consult with the Director of Undergraduate Studies to develop a program suited to their specific needs and interests.

*Related Work.* Greek majors normally take at least four courses in Latin and are also encouraged to take course work in ancient history and/or archaeology. The nature and amount of related work, however, may vary with the student.

## Latin

*Prerequisite.* Latin 64 or equivalent.

*Major Requirements.* Six courses in Latin above the level of Latin 100, and Classical Studies 195S or 196S. In addition, students will be required to pass an examination testing proficiency in Latin composition or to complete Latin 117T.

*Related Work.* Latin majors normally take at least four courses in Greek and are also encouraged to take course work in ancient history and/or archaeology. The nature and amount of related work, however, may vary with the student.

## Classical Studies (Ancient History, Civilization, or Archaeology)

*Prerequisites.* Classical Studies 11S and 12S; or 53 and 54.

*Major Requirements.* Eight courses above the level of 60, including Classical Studies 195S or 196S. Reading knowledge of Latin or Greek to the level of Latin 64 or Greek 64. Two courses in the ancient languages above that level may be counted toward the major.

## Honors

The department offers work leading to graduation with distinction. See the section on honors in this bulletin.

## Comparative Area Studies Program (CST)

Associate Professor Gordon, *Director*

A major is available in this program.

The undergraduate major in comparative area studies offers a Bachelor of Arts degree to students interested in the interdisciplinary study of societies and cultures of a particular region of the world. Students complement their study with either a concentration in a second world area or in the comparative study of international problems. The major allows a student to combine language study with courses in a variety of disciplines. As in area studies programs elsewhere, the result is a sustained focus on a single world area, tailored to fit the student's interest. Comparative Studies at Duke, however, is distinct from most such programs in several respects. The primary concentration encourages study of language, literature, religion, and art of the chosen area as well as analysis of its social, historical, and political roots and problems. The secondary concentration imparts breadth of focus and a comparative perspective to the course of study. And the required course on comparative methods focuses attention on the particular disciplinary concerns and approaches of the social sciences and humanities.

Students in the program are currently studying Latin America, the Caribbean, Africa, the Middle East, Russia, South Asia, East Asia, Western Europe, and Canada. Many comparative area studies majors "double-major" in comparative area studies and in such fields as anthropology, history, political science, Spanish, and French. Although the program provides all students with a solid background in liberal arts, it is specifically designed for those with career objectives in academia, government (especially the foreign service), international business, international law, health and environmental programs, the United Nations and international agencies, and private-international religious or service organizations.

The major draws its offerings from courses taught by over eighty Duke professors in a dozen cooperating departments. Interdisciplinary and intercultural courses have been designed specifically for majors in the program to help place those societies chosen for specialization in a broad comparative perspective. These courses stress the interrelationship of developed and underdeveloped societies and probe the difficulties and advantages of comparative, interdisciplinary, and intercultural research.

The program is administered by its director and an advisory committee representing the various areas and cooperating departments.



*Advising:* Students must identify their primary area focus. Faculty members with expertise in each area are available to provide advice concerning selection of an area and course work in the major. Students wishing to specialize in an area not indicated in the categories of courses that follow will be required to submit a proposed course of study to the advisory committee for approval. Selection of area is normally done by the end of the sophomore year. The program encourages close relationships between faculty and students working in similar areas.

*Study Abroad or on Another Campus:* The program encourages qualified and interested students to engage in sustained study abroad in their chosen area for a semester or for an academic year. Duke students are eligible for a variety of programs now operating in Africa, Asia, Canada, Latin America, the Soviet Union, and Western Europe. Students can also take advantage of special programs in the United States for intensive language training, legislative or foreign service study in Washington, and internship programs at the United Nations. Occasionally summer internships in a variety of structured programs, including international business, are available for qualified students.

The courses listed below may be taken for credit as introductory courses, comparative courses, and area courses. Others may be selected with the approval of the Director. Courses in basic language instruction are not included, but courses in advanced language and literature that can be used to meet the language requirement (not the area requirement) for the major are shown under the appropriate headings. For a complete description, including cross-listings, consult the listing under the appropriate department or under Interdisciplinary Courses.

## COMPARATIVE AREA STUDIES COURSES

**109. Contemporary International Problems: Their Historical Origins and Their Implications for Future Policy. (SS) C-L:** Cultural Anthropology 109, History 109, Political Science 160, and Sociology 175. One course. *Staff*

**125. Strategies of Comparative Analysis. (SS)** Comparative research and analysis in the social sciences and the humanities: strengths and weaknesses of cross-cultural comparison as developed by sociologists, historians, political scientists, anthropologists, and specialists in comparative literature and religion. C-L: Cultural Anthropology 125, History 137, Political Science 125, and Sociology 125. One course. *Staff*

**150S. Comparative Area Studies Senior Seminar. (CZ)** Open to seniors majoring in Comparative Area Studies and other seniors if space is available. Prerequisite: consent of instructor. One course. *Gordon*

## INTRODUCTORY COURSES

Comparative Area Studies 109. Contemporary International Problems: Their Historical Origins and Their Implications for Future Policy. *Staff*

Cultural Anthropology 94. Introduction to Cultural Anthropology. *Staff*

History 25. Introduction to World History: To 1700. *Staff*

History 26. Introduction to World History: Since 1700. *Staff*

History 75, 76. The Third World and the West. *R. Davis, Dirlik, Ewald, Gordon, or Richards*

Literature 101. Introduction to the Study of Literature and Society. *Willis*

Music 136S. Introduction to Non-Western Music. *Seebass*

Political Science 92. Comparative Politics. *Staff*

Religion 57. Introduction to the Religions of Asia. *Corless, Lawrence, Partin, or Robinson*

Sociology 110. Comparative Sociology. *Geneffi, Myers, Smith, or Tiryakian*

## COMPARATIVE COURSES

### Cultural Anthropology

114. Gender Inequality. *Quinn*

119. Language, Culture, and Society. *Apte or Weller*

152S. Food in Cross-Cultural Perspectives. *Apte*

155. Anthropological Approaches to Religion. *Weller*

239. Culture and Ideology. *Weller*  
255S. Heroes and Heroics: Culture and the Individual. *Fox*

#### **Economics**

- 219S. Economic Problems of Underdeveloped Areas. *Kelley or Naylor*  
286S. Economic Policy-Making in Developing Countries. *Gillis*

#### **History**

- 101C. Terrorism, 1848-1968. *M. Miller*  
120. History of Socialism and Communism. *Lerner*  
123S. Madness and Society in Historical Perspective. *Miller*  
167S. United States and Canadian Constitutional Issues. *Cahow*  
168S. The Atlantic Slave Trade. *Gaspar*  
233S. Slave Resistance and Social Control in New World Societies. *Gaspar*  
239S. History of Socialism and Communism. *Lerner*

#### **Interdisciplinary Courses**

- 120A. Perspectives on Food and Hunger. *Johns*  
120B. Perspectives on Food and Hunger. *Johns*  
140. The Great Mother: Archetype or Stereotype? *Wang*  
234S. Political Economics of Development: Theories of Change in the Third World. *Fox, Gereffi, or Smith*

#### **Literature**

121. Introduction to Non-Western Literatures. *Cooke and Fowler*  
129. Latin American Literature. *Dorfman or Fein*  
155. Comparative Perspectives on Literature and Social Change: From Plantation to City. *Willis*  
185. Psychoanalysis, Literature, and Film. *Gaines*

#### **Political Science**

107. Comparative Environmental Policies. *McKean*  
147. International Environmental Politics and Policies. *McKean*  
163. Gender, Politics, and Policy: The Third World Case. *O'Barr*  
173S. Political Economy of World Food Problems. *Johns*  
212S. Domestic Structures and Foreign Policies of Advanced Democratic States. *Grieco*  
231S. Crisis, Choice, and Change in Advanced Democratic States. *Kitschelt*  
237S. Comparative Public Policy. *Kitschelt*  
242S. Comparative Law and Policy: Ethnic Group Relations. *Horowitz*  
249. Comparative International Development and Technology Flow. *Staff*  
259S. Low Intensity Conflict and the Lessons of Vietnam. *Lomperis*  
262S. International Communism. *Hough*  
277. Comparative Party Politics. *Kornberg or Lange*  
284S. Public Policy Process in Developing Countries. *Ascher*  
293. Federalism. *Leach*

#### **Public Policy Studies**

- 284S. Public Policy Process in Developing Countries. *Ascher*  
286S. Economic Policy-Making in Developing Countries. *Conrad or Gillis*

#### **Religion**

125. Women and Sexuality in the Christian Tradition. *Clark*  
142. Comparative Mythology. *Partin*  
143. Mysticism. *Staff*  
157. Bioethics in Comparative Contexts. *McCullough*  
282. Myth and Ritual. *Robinson and staff*

#### **Sociology**

118. Sex, Gender, and Society. *O'Rand*  
126. Third World Development. *Gereffi*  
170. Mass Communication. *Smith*  
171. Comparative Health Care Systems. *Maddox*  
173. Social Conflict and Social Development. *Tiryakian or Wilson*  
179. Modern Nationalist Movements. *Tiryakian*  
180. Modern Revolutions. *Tiryakian*  
182. Media in Comparative Perspective. *Paletz or Smith*  
214. Comparative and Historical Methods. *Janoski, Smith, or Tiryakian*  
222B. Comparative Aspects of Societal Transformation. *Gereffi, Simpson, Smith, or Tiryakian*

## AREA COURSES: AFRICA

### Arabic

100. North African Culture. (Taught in Morocco.) *Cooke*

### Cultural Anthropology

122. Modern Africa. *O'Barr*

### History

115. History of Africa. *Ewald*

179. History of South Africa, 1600-1960. *Ewald*

195S.23, 196S.23. Issues in the History of Tropical Africa. *Ewald*

### Interdisciplinary Course

164. History and Religions of North Africa. (Taught in Morocco.) *Lawrence*

### Literature

128. Writings in the Pan-African Tradition. *Willis*

### Political Science

161S. Comparative Government and Politics: Africa. *Bates or Johns*

171. Politics of South African Apartheid. *Johns*

### Religion

265. Religions of the West African Diaspora. *Lincoln*

## AREA COURSES: CANADA

### English

186. Canadian Literature in English. *Staff*

### French

131S. French in the New World. *Hull*

169. The Contemporary Novel in French Canada. *Keinig and staff*

### History

183S. Canada from the French Settlement. *Cahow*

### Interdisciplinary Courses

184. An Introduction to Canada and Canadian Issues. *Cahow*

282S. Canada. *Cahow*

## AREA COURSES: CARIBBEAN

### Afro-American Studies

265. Religions of the West African Diaspora. *Lincoln*

### Cultural Anthropology

128. Caribbean Societies and Cultures. *Dominguez*

### History

115. History of Africa. *Ewald*

124S. Slave Society in Colonial Anglo-America: The West Indies, South Carolina, and Virginia. *Gaspar*

131. Mexico and the Spanish Caribbean in the Nineteenth and Twentieth Centuries. *TePaske*

145, 146. Afro-American History. *Gavins*

168S. The Atlantic Slave Trade. *Gaspar*

174. History of Colonial Hispanic America from Pre-Columbian Times to the Wars of Independence. *TePaske*

### Literature

128. Writings in the Pan-African Tradition. *Willis*

155. Comparative Perspectives on Literature and Social Change: From Plantation to City. *Willis*

## AREA COURSES: EAST ASIA

### Art

165. Topics in Oriental Art. *Lee*

### Chinese

125, 126. Advanced Chinese. *Staff*

141S. The Fantastic in Chinese Fiction. *Wang*

142S. Masterpieces of Chinese Literature in Translation. *Kunst*

166S. *The I Ching, or Book of Changes*. *Kunst*



171. The Novel in Modern China. *Kunst*  
 182S. Classical Readings in Chinese Philosophy (in Chinese). *Wang*  
 183, 184. Topics in Modern Chinese. *Kunst or Wang*  
 Additional Chinese courses are taught in Beijing and Nanjing as part of the Duke Study in China Program.

#### **Cultural Anthropology**

121. China: Tradition and Transformation. *Weller*  
 131. Socialism and Society in China. *Weller*  
 163. Foundations of Chinese Civilization. (Taught in China.) *Staff*

#### **History**

- 101K. Topics in Chinese Civilization. *Dirlik*  
 139. China since 1949: The People's Republic. *Dirlik*  
 141. Imperial China. *R. Davis*  
 142. China: Roots of Revolution. *Dirlik*  
 143. Ancient and Early Modern Japan. *Gordon*  
 144. The Emergence of Modern Japan. *Gordon*  
 163. Foundations of Chinese Civilization. (Taught in China.) *Staff*  
 195S.07, 196S.07. Socialism and Revolution in East Asia. *Dirlik*  
 195S.17, 196S.17. Problems in the History of Modern Japan. *Gordon*  
 195S.30, 196S.30. Traditions in China and the West. *R. Davis*  
 243, 244. Marxism and History. *Dirlik*  
 245, 246. Social and Intellectual History of China. *R. Davis and Dirlik*

#### **Japanese**

- 155, 156. Readings in Modern Japanese. *Kuriya and staff*  
 161. Modern Japanese Fiction in Translation. *Fowler*  
 175. Structure of Japanese. *Nagai*  
 183, 184. Topics in Japanese. *Fowler or staff*

#### **Music**

138. Music in East and Southeast Asia. *Seebass*

#### **Political Science**

111. Contemporary Japanese Politics. *McKean*  
 132. Politics of Asia. *Lomperis*  
 149. United States and East Asia. *McKean*  
 169. Politics in Revolutionary China. *McKean*

#### **Religion**

141. Religions of China and Japan. *Corless*  
 149. Buddha and Buddhism. *Corless*  
 218. Religions of East Asia. *Corless*  
 287. The Scriptures of Asia. *Staff*

### **AREA COURSES: LATIN AMERICA**

#### **Art**

178. Pre-Columbian Art and Architecture. *Reents-Budet or Sund*

#### **History**

128. The United States and Latin America. *Staff*  
 131. History of Mexico and the Spanish Caribbean in the Nineteenth and Twentieth Centuries. *TePaske*  
 173. History of Spain from Late Medieval Times to the Present. *TePaske*  
 174. History of Colonial Hispanic America from Pre-Columbian Times to the Wars of Independence. *TePaske*  
 177. Modern Latin America. *Staff*  
 195S.22, 196S.22. Problems in Latin-American History. *TePaske*  
 231S, 232S. Problems in the History of Spain and the Spanish Empire. *TePaske*  
 265S. Problems in Latin American History. *Staff*

#### **Cultural Anthropology**

- 124S. The American Indian. *Staff*  
 127. Social Transformations in Central America. *Smith*  
 128. Caribbean Societies and Cultures. *Dominguez*  
 173. Revolutions in Latin America. *Smith*

#### **Political Science**

151. Introduction to Latin-American Politics. *Staff*  
 253S. Comparative Government and the Study of Latin America. *Staff*

## Portuguese

- 181. Brazilian Portuguese. *Staff*
- 182. Topics in Portuguese and Brazilian Literature and Culture. *Staff*

## Spanish

- 105, 106. Introduction to Spanish-American Literature. *Fein or Ross*
- 107S. Spanish-American Short Fiction. *Fein*
- 121. Latin American Literature in Translation. *Fein*
- 131. Topics of Hispanic Civilization. *Staff*
- 146. The Spanish-American Novel. *Fein*
- 166. Nineteenth-Century Prose Fiction. *Pérez Firmat or Sieburth*
- 171. Literature of Contemporary Spain. *Osuna*
- 210. History of the Spanish Language. *Garcí-Gómez*
- 245. Modern Spanish-American Poetry. *Fein*
- 246. Modern Spanish-American Fiction. *Pérez Firmat*

## AREA COURSES: MIDDLE EAST

### Arabic

- 100. North African Culture. (Taught in Morocco.) *Cooke*
- 173S. Women in Arabic Literature. *Cooke*

### Cultural Anthropology

- 126. Middle East: Wars, Revolutions, and Social Change. *Dominguez*
- 147, 148. Introduction to Islamic Civilization. *Lawrence and staff*

### History

- 101G, 102G. Introduction to Islamic Civilization. *Lawrence and staff*
- 159S. The Palestine Problem and United States Public Policy. *Kuniholm*

### Interdisciplinary Courses

- 162, 163. Introduction to Islamic Civilization. *Lawrence and staff*
- 164. History and Religions of North Africa. (Taught in Morocco.) *Lawrence*

### Political Science

- 177, 178. Contemporary Social and Political Development in the Islamic World. *Staff*
- 235S. Comparative Development of Islam. *Staff*

### Public Policy Studies

- 175S. The Palestine Problem and United States Public Policy. *Kuniholm*
- 257. United States Policy in the Middle East. *Kuniholm*

### Religion

- 110. Archaeology and Art of the Biblical World. *C. Meyers or E. Meyers*
- 134. Jewish Mysticism. *Bland*
- 135. Jewish Religious Thought. *Bland*
- 136. Contemporary Jewish Thought. *Bland or E. Meyers*
- 152. Islamic Mysticism. *Lawrence*
- 162, 163. Introduction to Islamic Civilization. *Lawrence and staff*
- 283. Islam and Modernism. *Lawrence*

## AREA COURSES: RUSSIA AND EAST EUROPE

### Economics

- 293. Soviet Economic History. *Trenl*
- 294S. Soviet Economic System. *Trenl*

### History

- 120. History of Socialism and Communism. *Lerner*
- 161, 162. History of Modern Russia. *M. Miller*
- 180. The Soviet Experience. *Lerner*
- 195S.18, 196S.18. Problems in the History of Russia before 1917. *Lerner or M. Miller*
- 201S. The Russian Intelligentsia and the Origins of the Revolution. *M. Miller*
- 202S. The Russian Revolution. *M. Miller*
- 239S. History of Socialism and Communism. *Lerner*
- 262. Problems in Soviet History. *Lerner*

### Political Science

- 165. Government and Politics of the Soviet Union. *Hough*
- 166. Soviet Foreign Relations. *Hough*

## Russian

- 100. Studies in Russian Culture. (Taught in Leningrad.) *Andrews*
- 124. Masters of Russian Short Fiction. *Staff*
- 150. The Languages of the Soviet Union. *Pugh*
- 161, 162. Introduction to the Russian Novel. *Staff*
- 175. Tolstoy. *Staff*
- 176. Dostoevsky. *Staff*
- 185S. Introduction to Slavic Linguistics. *Andrews*
- 186S. History of the Russian Language. *Pugh*
- 196. Readings in Modern Russian. *Staff*
- 225. Tolstoy. *Staff*
- 232. Dostoevsky. *Staff*

## AREA COURSES: SOUTH ASIA

### Cultural Anthropology

- 101, 102. Introduction to the Civilizations of Southern Asia. *Apte or Fox*

### History

- 140. Medieval and Early Modern India, Pakistan, and Bar. Jadesh. *Richards*
- 164. India, Pakistan, and Bangladesh: 1750 to the Present. *Richards*
- 193, 194. Introduction to the Civilizations of Southern Asia. *Fox and staff*
- 195S.21, 196S.21. Problems in Indian History. *Richards*

### Interdisciplinary Courses

- 162, 163. Introduction to Islamic Civilization. *Lawrence and staff*

### Music

- 138. Music in East and Southeast Asia. *Seebass*

### Political Science

- 132. Politics of Asia. *Lomperis*
- 177, 178. Contemporary Social and Political Development in the Islamic World. *Staff*

### Religion

- 140. Religions of India. *Lawrence and staff*
- 145. Social Issues in Contemporary Hinduism. *Robinson*
- 149. Buddha and Buddhism. *Corless*
- 160, 161. Introduction to the Civilizations of Southern Asia. *Fox and staff*
- 217. Islam in India. *Lawrence*
- 284. The Religion and History of Islam. *Partin*
- 287. The Scriptures of Asia. *Staff*
- 288. Buddhist Thought and Practice. *Corless*

## AREA COURSES: WESTERN EUROPE

### Art

- 161. Nineteenth-Century European Art. *Cernuschi or Sund*
- 164. Art of the Romantic Period. *Sund*
- 184. History of Impressionism. *Cernuschi or Sund*
- 186. Twentieth-Century Art. *Cernuschi, Stiles, or Sund*
- 187. Surrealism. *Stiles*

### Distinguished Professor Courses

- 196S. Current Political Problems in Western European and Commonwealth Countries. *Cole*

### Economics

- 150. History of Economic Thought. *de Marchi or Goodwin*

### French

- 107S. Contemporary Ideas. *Staff*
- 113. French for Business and Law. *Bryan*
- 136S. Life in Eighteenth-Century France. *Stewart*
- 137. Aspects of Contemporary French Culture. *Staff*
- 139. French Civilization. *Keinig or Tetel*
- 166, 167. Contemporary French Life and Thought. *Kaplan*
- 256. Modern Literature and History. *Orr*

### Germanic Languages and Literature

- 127S. Contemporary Germany. *Bessent*



- 129. Deutsche Kulturgeschichte. *Staff*
- 130. German Life and Thought. *Borchardt*
- 175. Consciousness and Modern Society. *Rolleston*

#### History

- 104. The Intellectual Life of Europe, 1250-1600. *Robisheaux or Witt*
- 107,108. Social and Cultural History of England. *Cell or Herrup*
- 117. Early Modern Europe. *Neuschel*
- 119. Modern European Intellectual and Cultural History. *M. Miller*
- 135. Germany from the Thirty Years' War to Unification in 1871. *Koonz*
- 136. Germany since Unification in 1871. *Koonz*
- 138. Early Modern Germany. *Robisheaux*
- 171. A History of Women in Europe. *Neuschel*
- 173. History of Spain from Late Medieval Times to the Present. *TePaske*
- 174. History of Colonial Hispanic America from Pre-Columbian Times to the Wars of Independence. *TePaske*
- 182. Politics and Culture in Renaissance Florence. *Witt*
- 188. German History from 1870 to 1970. (Taught in Germany.) *Staff*
- 195S, 196S. Selected Seminars in European History. *Staff*
- 199. The History of Women in Science and Medicine. *Green*
- 207, 208. Constitutional History of Britain: The Rise of the Common Law. *Herrup*
- 217S, 218S. Western Europe in the Twentieth Century. *Colton*
- 221. Problems in the Economic and Social History of Europe, 1200-1700. *Neuschel or Robisheaux*
- 231S-232S. Problems in the History of Spain and the Spanish Empire. *TePaske*
- 253S, 254S. European Diplomatic History, 1871-1945. *W. Scott*
- 267S. England in the Sixteenth Century. *Herrup*
- 268S. England in the Seventeenth Century. *Herrup*
- 269S, 270S. British History, Seventeenth Century to the Present. *Cell*

#### Literature

- 132. Dada and Surrealism. *Thomas*

#### Music

- 119. The Humanities and Music. *Bartlett, Higgins, or Seebass*
- 125. Masterworks of Music. *Druessedow, Henry, Muti, or Todd*
- 143. Beethoven and His Time. *Bartlet, Gilliam, Silbiger, or Todd*
- 144. Bach and His Time. *Hill or Silbiger*
- 145. Mozart and His Time. *Seebass*
- 156S. Music History II: Late Renaissance, Baroque. *Bartlet, Higgins, Seebass, Silbiger, or Williams*
- 157S. Music History III: Rococo and Classic. *Bartlet, Seebass, Silbiger, or Todd*
- 158S. Music History IV: Romanticism to the Early Modern Period. *Bartlet, Gilliam, Silbiger, or Todd*

#### Political Science

- 115. Politics and Society in West Germany. *Kitschelt*
- 134. West Germany and East Germany: From Confrontation to Normalization. (Taught in Germany.) *Staff*
- 135. Political Development of Western Europe. *Kitschelt or Lange*
- 136. Comparative Government and Politics: Western Europe. *Kitschelt, Lange, or Tsebelis*
- 216S. Evolutions of European Marxism. *Staff*
- 225. Topics in Comparative Government and Politics: Western Europe. *Kitschelt or Lange*
- 232. Political Economy: Theory and Applications. *Lange*

#### Spanish and Portuguese

See appropriate listings under Latin America.

## THE MAJOR

### For Students Who Matriculated before May 1988:

*Introductory Courses:* A student must take an introductory course emphasizing comparative approaches from each of two departments (two courses). See the listing under Introductory Courses.

*Foreign Language Requirement:* Four semesters of courses for a single language of the primary area are required. Students with advanced placement credits or other evidence of foreign language proficiency are not exempted from this requirement. However, in the following cases students may substitute one or two nonlanguage courses to meet this requirement: (1) if a second year of a language is not taught at Duke or (2) if no language course is available at a sufficiently advanced level. In these cases, approved humanities

or social science courses taught in a foreign language, or a year of general linguistics or literature in translation, may be substituted for the second year of a language. The specific language courses are too numerous to list here. Area advisors should be consulted for specific approval of the language choice unless it conforms to the list below.

*Africa:* Swahili; relevant European languages such as French may be used if appropriate to specific programs.

*East Asia:* Chinese, Japanese.

*South Asia:* Hindi-Urdu.

*Middle East:* Arabic, Persian; or modern Hebrew for persons specializing in Israel.

*Latin America:* Spanish; Portuguese for those specializing in Brazil.

*Russia and Eastern Europe:* Russian.

*Western Europe:* French, German, Italian, Portuguese, Spanish.

*Canada:* French.

*Primary Area Courses:* Four semester courses in the geographical area of special interest (the area of the language studied). The areas and courses are listed above. Others may be selected with the consent of the Director.

*Secondary Concentration:* The secondary concentration is intended to provide a comparative perspective on the student's primary area of study and to focus attention on Third World as well as Western societies. A student must take three courses in one of the following concentrations: comparative courses, examples of which are listed above; or a second geographical area. Students who choose Western Europe or Russia/Eastern Europe as a primary area must take a non-European or comparative secondary area. Similarly, students who choose either Latin America or the Caribbean as their primary area may not take the other of this pair as the secondary area.

*Comparative Methods Course and Senior Seminar:* All students must take either the comparative methods course (Comparative Area Studies 125) in their junior or senior year, or the Honors Seminar (Comparative Area Studies 150S) in their senior year. The former course (Comparative Area Studies 125) will be taught by faculty members affiliated with comparative area studies and is open only to majors. The purpose of this course is to teach students the various strategies that can be employed in making appropriate comparisons within and across distinct regions of the world. The course will combine a lecture format with discussion sections, and students will be encouraged to write papers that reflect the cross-cultural and interdisciplinary objectives of the major. The optional honors seminar will be open to seniors in the major. Candidates will apply in their junior year and be selected by the comparative area studies faculty. Selection criteria include the feasibility of the proposed topic and the student's motivation and skills to carry it out successfully.

### **For Students Who Matriculated after May 1988:**

1. *Corequisite Foreign Language Requirement:* Four (4) courses in a single language of the primary area studied. Detailed requirements same as above.

2. *Major Requirements:*

A. *Introductory Courses:* Two (2) introductory courses emphasizing comparative approaches, one from each of two departments. See list under Introductory Courses.

B. *Primary Area Courses:* Four (4) semester courses in the geographical area of special interest (the area of the language studied). Areas and courses are listed above. Others may be selected with the consent of the Director.

C. *Secondary Concentration:* Three (3) courses in the secondary area of concentration or three comparative courses. Detailed requirements the same as above.

D. *Comparative Area Studies 125, Strategies of Comparative Analysis:* usually taken in the junior or senior year.

3. *Honors Seminar*: For graduation with distinction or honors by honors project, a research project completed in senior year, usually in the Comparative Area Studies 150S senior seminar. For detailed requirements and application, consult the comparative area studies office.

Inquiries should be addressed to the Director, Comparative Area Studies, 2122 Campus Drive.

## Comparative Literature Program

See Literature: Undergraduate Courses in the Literature Program.

## Computer Science (CPS)

Professor Rose, *Chairman*; Associate Professor Ramm, *Associate Chairman*; Professor Biermann, *Director of Undergraduate Studies*; Professors Gallie, Loveland, Marinos, Patrick, Reif, Starmer, Trivedi, Utku, and Woodbury; Associate Professors Dugan, C. Ellis, J. Ellis, Greenside, Kedem, Kootsey, and Wagner; Assistant Professors Board, Gardner, Holliday, Nadathur, and Szyld; Adjunct Associate Professor Coughran

A major is available in this department.

The Department of Computer Science provides courses on the concepts of computing and computers, their capabilities, and uses. In most courses students make extensive use of the available computing facilities. Students who wish to take a single introductory course, as part of their general education, usually elect Computer Science 10 or 51.

In cooperation with the Microelectronics Center of North Carolina (MCNC), the University of North Carolina at Chapel Hill, and other MCNC-affiliated universities in North Carolina, the department often sponsors advanced computer science and other high technology courses originating at other universities. These are available through a closed circuit television and data network belonging to MCNC. Contact the Department of Computer Science for further information on the availability of such courses.

**10. Computer Science Fundamentals. (QR)** An introduction to computers for students who do not intend to major in computer science. Fundamental concepts of the nature of computers and computability, programming, numeric and symbolic data processing. Not open to students having credit for Computer Science 51 or higher. One course. *Staff*

**51. Introduction to Computer Programming. (QR)** Problem solving using a digital computer. Use of a high level algorithmic programming language. Students expected to write a substantial number of programs. Use of a computer in laboratory-style classes utilizing personal computers. One course. *Kootsey and staff*

**53. Programming, Analysis, and Design I. (QR)** Computer programming, data structures, analysis and design of algorithms. Intended as a first course for students in the B.S. degree program. One course. *Staff*

**102. Data Structures. (QR)** Linear lists, trees, multilinked structures, and their use in algorithms. Prerequisite: Computer Science 51, 53, or equivalent. One course. *Staff*

**103. Programming, Analysis, and Design II. (QR)** A continuation of Computer Science 53. Prerequisite: Computer Science 53. One course. *Staff*

**104. Computers and Programming. (QR)** Computer structure, machine language, instruction execution, addressing techniques, and digital representation of data. Computer systems organization, logic design, microprogramming, and interpreters. Symbolic coding and assembly systems. Prerequisite: Computer Science 102 or 103 or consent of instructor. One course. *Ramm and staff*



**106. Programming Languages. (QR)** Syntax and semantics of programming languages. Compilation, interpretation, and programming environments; including programming languages such as Algol, PL/1, Pascal, APL, LISP, and Prolog. Exercises in programming. Prerequisite: Computer Science 104. One course. *Staff*

**121. Introduction to Numerical Methods. (QR)** Numerical solution of systems of linear and nonlinear equations and of ordinary differential equations. Polynomial and spline interpolation. Integration. Least squares. Prerequisites: Computer Science 102 and Mathematics 103 and 104. One course. *Staff*

**125. Mathematical Foundations of Computer Science. (QR)** An introduction to theoretical computer science including studies of abstract machines, the language hierarchy from regular sets to recursively enumerable sets, noncomputability, and complexity theory. Prerequisites: Computer Science 53 and 103 and Mathematics 103. One course. *Staff*

**131. Introduction to Operating Systems. (QR)** Basic concepts and principles of multiprogrammed operating systems. Processes, interprocess communication, CPU scheduling, mutual exclusion, deadlocks, memory management, I/O devices, file systems, protection mechanisms. Prerequisites: Computer Science 102 and 104. One course. *Holiday*

**155. Program Design and Construction. (QR)** Substantial programs. Design specifications, choice of data structures, estimation of programming effort, stepwise development, and program-testing methodology. Programming teams and human factors in system implementation. Advanced topics in use of a procedural language and file management. Prerequisite: Computer Science 104. One course. *Staff*

**157. Introduction to Switching and Automata Theory. (QR)** See C-L: Electrical Engineering 157. One course. *Carroll or Strole*

**160. Digital Electronics and Computer Hardware.** The basics of DC and AC circuit analysis, digital circuitry, MOS devices and hybrid designs, timing considerations. Switching characteristics of transistors and simple amplifier circuits. Speed, power, fanin and fanout, and cost as a basis of comparison of different logic families. Applications to digital system design. Not open to biomedical or electrical engineering majors. Prerequisite: Physics 52. C-L: Electrical Engineering 160. One course. *Dollas or Dugan*

**174. Analysis of Algorithms. (QR)** Design and analysis of efficient algorithms for sorting, searching, dynamic structure manipulation, pathfinding, fast multiplication, and others; nondeterministic algorithms and computationally hard problems. Prerequisites: Computer Science 102 and four semesters of college mathematics. One course. *Loveland*

**191, 192. Independent Study.** Directed reading and research for qualified juniors. Prerequisites: consent of instructor and Director of Undergraduate Studies. One course each. *Staff*

**193, 194. Independent Study.** Directed reading and research for qualified seniors. Prerequisites: consent of instructor and Director of Undergraduate Studies. One course each. *Staff*

### **For Seniors and Graduates**

**200. Programming Methodology. (QR)** Practical and theoretical topics including structured programming, specification and documentation of programs, debugging and testing strategies, choice and effective use of programming languages and systems, psychology of computer programming, proof of correctness of programs, analysis of algorithms, and properties of program schemata. Prerequisite: Computer Science 102. One course. *Staff*

**201. Programming Languages. (QR)** Information binding, data structures and storage, control structures, recursion, execution environments, input/output; syntax and semantics of languages; study of PL/1, Fortran, Algol, APL, LISP, SNOBOL, and SIMULA; exercises in programming. Prerequisite: Computer Science 200. One course. *Staff*

**202. Applied Discrete Structures. (QR)** Aspects of discrete mathematics that are essential to the development of computer science. Topics from combinatorics and graph theory, discrete probability theory, and mathematical logic. Prerequisites: Mathematics 103 and 104 or equivalents. One course. *Staff*

**204. Computer Network Architecture.** Prerequisite: Electrical Engineering 157. See C-L: Electrical Engineering 204. One course. *Strole*

**207. Fault-Tolerant Computer Systems.** See C-L: Electrical Engineering 207. One course. *Marinos*

**208. Digital Computer Design.** Prerequisite: Computer Science 157 or consent of instructor. See C-L: Electrical Engineering 208. One course. *Marinos*

**209. Microprocessor Fundamentals and Applications.** Prerequisites: Computer Science 157 and consent of instructor. See C-L: Electrical Engineering 209. One course. *Marinos*

**210. Introduction to VLSI Design.** A first course in VLSI design with CMOS technologies. A study of devices, circuits, fabrication technology, logic design techniques, subsystem design and system architecture. Modeling of circuits and subsystems. Testing of gates, subsystems and chips, and design for testability. The fundamentals of full-custom design, and some semi-custom design. Prerequisites: logic design (Computer Science/Electrical Engineering 157 or equivalent), and electronics (EE 161, or CPS/EE 160, or equivalent). C-L: Electrical Engineering 210. One course. *Dollas or Kedem*

**212. Introduction to Scientific Computing.** Practical introduction for students and faculty to computer resources that facilitate scientific research: scientific word processing (Tex and LaTeX), symbolic manipulation programs, software tools, numerical software packages, and graphics. Case studies used to illustrate these resources. For noncomputer scientists. Prerequisites: Mathematics 103, 104, or equivalent; some programming experience. One course. *Gardner or Greenside*

**213. Introduction to Nonlinear Dynamics.** Introduction to the mathematical theory of nonlinear dynamics, and how this theory compares with physical experiments, with applications to biology (Turing states and morphogenesis), computer science (randomness and computability), mathematics (chaos and strange attractors), and physics (pattern formation and transition to turbulence). Prerequisites: Mathematics 111, Physics 51, 52, and Computer Science 51. C-L: Physics 213. One course. *Greenside*

**215. Artificial Intelligence. (QR)** Heuristic versus algorithmic methods; programming of games such as chess; theorem proving and its relation to correctness of programs; readings in simulation of cognitive processes, problem solving, semantic memory, analogy, adaptive learning. Prerequisite: Computer Science 102 or consent of instructor. One course. *Biermann, Loveland, or Nadathur*

**221. Numerical Analysis. (QR)** Error analysis, interpolation and spline approximation, numerical differentiation and integration, solutions of linear systems, nonlinear equations, and ordinary differential equations. Prerequisites: knowledge of an algorithmic programming language, intermediate calculus including some differential equations, and Mathematics 104. C-L: Mathematics 221. One course. *Gardner, Greenside, or Szyld*

**222. Numerical Differential Equations. (QR)** Numerical methods for solving ordinary and partial differential equations emphasizing nonlinear differential equations. Methods for solving ordinary differential equations that generalize to solve partial differential equations: finite difference, spectral, and finite element methods. Solution of hyperbolic, parabolic, and elliptical partial differential equations arising in scientific problems. Prerequisite: Computer Science 221. C-L: Mathematics 222. One course. *Gardner, Greenside, Rose, or Szyld*

**223. Numerical Linear Algebra. (QR)** Solution of large, sparse linear systems of equations. Storage schemes, graph theory for sparse matrices, different orderings to minimize fill, block factorizations, iterative methods, analysis of different splittings, conjugate gradient methods. Eigenvalue problems, QR factorization, Lanczos method, power method and inverse iteration, Rayleigh quotient. Prerequisite: Computer Science 221 or equivalent. C-L: Mathematics 223. One course. *Gardner, Greenside, Rose, or Szyld*

**224. Analysis of Algorithms. (QR)** Design and analysis of efficient algorithms. Design techniques include recursion, divide-and-conquer, and dynamic programming. Applications include sorting, searching, dynamic structures, pathfinding, fast multiplication, fast Fourier transform. Nondeterministic algorithms. Computationally hard problems. NP-completeness. This course is the same as Computer Science 174 with more advanced-level work required of the student. Prerequisites: Computer Science 102 and four semesters of college mathematics. One course. *Loveland*

**225. Formal Languages and Theory of Computation. (QR)** An introduction to the study of abstract machines and the languages they define, their capabilities, and limitations. Finite-state automata, regular languages, pushdown automata, context-free languages, Turing machines, recursive functions and recursively enumerable sets, noncomputable sets, measures of complexity for algorithms. Prerequisite: four courses in college mathematics. One course. *Loveland or Reif*

**226. Mathematical Methods for Systems Analysis I. (QR)** Basic concepts and techniques used in the stochastic modeling of systems. Elements of probability, statistics, queuing theory, and simulation. Prerequisite: four courses in college mathematics. One course. *Trivedi*

**227. Mathematical Methods for Systems Analysis II. (QR)** Basic concepts and techniques used in the deterministic modeling of systems. Elements of linear algebra; linear, integer, dynamic, and geometric programming; and unconstrained and constrained optimization. Prerequisite: four courses in college mathematics. One course. *Trivedi*

**231. Operating Systems. (QR)** Fundamental principles of operating system design applied to state-of-the-art computing environments (multiprocessors and distributed systems) including process management (coscheduling and load balancing), shared memory management (data migration and consistency), and distributed file systems. Advanced topics include transaction-based operating systems, reliable communication protocols, concurrency control and recovery mechanisms, computer security, and performance analysis. One course. *Staff*

**232. Compiler Construction. (QR)** Models and techniques used in the design and implementation of assemblers, interpreters, and compilers. Lexical analysis, compilation of arithmetic expressions and simple statements, specifications of syntax, algorithms for syntactic analysis, code generation and optimization techniques. One course. *Wagner*

**241. Data Base Methodology. (QR)** Basic concepts and principles. Relational, hierarchical, and network approaches to data organization; data entry and query language support for data base systems; theories of data organization; security and privacy issues.



Prerequisites: Computer Science 104 and either 155 or equivalent. C-L: Mechanical Engineering 242. One course. *Starmer*

**245. Functional Analysis for Scientific Computing. (QR)** Linear spaces, topologies, norms, and completeness. Focus on Banach and Hilbert spaces including Sobolev spaces. Linear and nonlinear operators. Fréchet derivatives. Iterative methods for nonlinear operator systems, such as Newton-like methods. Applications. Intended for science and engineering students but not mathematics graduate students. Prerequisite: Computer Science 221. C-L: Mathematics 245. One course. *Rose or Szyld*

**252. Computer Systems Organization.** Hardware and software aspects. Processor, memory, device, and communication subsystems; case studies of hardware system organization, for example, parallel, associative, fault-tolerant; organization of software systems to exploit hardware systems organization; economic and reliability aspects of various hardware organizations. Prerequisites: Computer Science 104 and 157. C-L: Electrical Engineering 252. One course. *Trivedi*

**265. Advanced Topics in Computer Science.** One course. *Staff*

**276. Communication, Computation, and Memory in Biological Systems. (QR)** Communication and memory in biological systems: voltage sensitive ion channels, hormone-receptor interactions, and initiation and control of RNA/DNA synthesis. Models of signaling and memory are developed and related to electronic signaling schemes. Prerequisites: Computer Science 102, two semesters of college chemistry, and four semesters of college mathematics. One course. *Starmer*

## THE MAJOR

### For the B.A. Degree

*Prerequisites.* Computer Science 51; Mathematics 33 (or 31), 34 (or 32), 105 (or 103), 106 (or 104).

*Major Requirements.* Computer Science 102, 104, 106, 121 (or Mathematics 160), and 131; one elective course at the 100 level or above in Computer Science, Electrical Engineering, or Mathematics; and Mathematics 135 or Statistics 100. If Mathematics 135 is elected, it is strongly recommended that it be followed by Mathematics 136. Students must complete at least five additional courses at the 100 level or above (excluding Mathematics 103, 104, 105, and 106) in one department other than computer science or in an approved area. A list of areas which have been approved by the department, such as the zoology-chemistry combination often chosen by premedical students, may be obtained from the Director of Undergraduate Studies.

### For the B.S. Degree

*Prerequisites.* Chemistry 11; Mathematics 33 (or 31), 34 (or 32), 105 (or 103), 106 (or 104); Physics 51 and 52.

*Major Requirements.* Computer Science 53, 103, 104, 106, 121, 125, and 131; two elective courses at the 100 level or above in computer science, electrical engineering, or mathematics; Electrical Engineering 157; Mathematics 135 or Statistics 100; and Mathematics 124 or 187. If Mathematics 135 is selected, it is recommended that Mathematics 136 be taken also.

Students who begin the B.A. program and later wish to transfer to the B.S. program should consult the Director of Undergraduate Studies.

## Honors

Students who are qualified (see the section on honors in this bulletin) may undertake work leading to a B.A. or B.S. degree with distinction in computer science by apply-

ing to the Director of Undergraduate Studies. Normally, candidates must have grades of A in computer science courses. They must complete a substantial project, suitably documented, or a distinguished paper on which they will be examined orally by a committee of three faculty members.

## **Cultural Anthropology (CA)\***

Professor Friedl, *Acting Chairman*; Associate Professor Dominguez, *Director of Undergraduate Studies*; Professors Apte, Cartmill, Fox, and O'Barr; Associate Professors Quinn and Smith; Professor Emeritus La Barre; Adjunct Assistant Professor Weller

A major is available in anthropology.

Cultural anthropology is a comparative discipline that studies the world's peoples and cultures. It emphasizes the application of the perspectives which anthropology developed from its initial concentration on the primitive world to studies of complex societies including rural, urban, and ethnic segments of the Third World and contemporary industrial nations.

Cultural anthropology is divided into three subdisciplines: ethnology, archaeology, and linguistics. Ethnologists, or social /cultural anthropologists as they may be called, study development and change in the form and the process of social organization among contemporary human populations. Archaeologists concern themselves with events and processes of the human unwritten past. Anthropological linguists work with languages of the present and past and trace the relationship between language and culture. The department offers courses in the three subdisciplines.

Students without prerequisites for a course may ask the instructor for admission.

**49S. Freshman Seminar.** Topics vary each semester offered. One course. *Staff*

**94. Introduction to Cultural Anthropology. (SS)** The dynamics of culture and society; form and function of social institutions. Emphasis upon primitive and complex societies. C-L: Comparative Area Studies. One course. *Staff*

**94D. Introduction to Cultural Anthropology. (SS)** Same as Cultural Anthropology 94 except instruction is provided in two lectures and one small discussion meeting each week. C-L: Comparative Area Studies. One course. *Staff*

**94S. Introduction to Cultural Anthropology. (SS)** See Cultural Anthropology 94. C-L: Comparative Area Studies. One course. *Staff*

**107. Introduction to Linguistics. (SS)** Origin and nature of language; methods of descriptive linguistics with reference to historical and comparative linguistics. C-L: English 111, Interdisciplinary Course 111, and Linguistics. One course. *Butters, Nygard, or Tetel*

**109. Contemporary International Problems: Their Historical Origins and Their Implications for Future Policy. (SS)** C-L: Comparative Area Studies 109, History 109, Political Science 160, and Sociology 175. One course. *Staff*

**110. Advertising and Society. (SS)** History and development of commercial advertising; advertising as a reflector and/or creator of social and cultural values; advertisements as cultural myths; effects on children, women, and ethnic minorities; advertising and language; relation to political and economic structure; and advertising and world culture. Primary emphasis on American society with consideration of selected other cultures. C-L: English 120, Sociology 160, and Women's Studies. One course. *O'Barr, J. Smith, or Wilson*

**112. Current Topics in Linguistics. (SS)** Advanced study of an area of linguistics or grammar. C-L: English 119, Interdisciplinary Course 119, and Linguistics. One course. *Staff*

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\*Proposed title at time the bulletin went to press.

**113. The Cultural Construction of Gender. (SS)** Explanation of differing gender beliefs cross-culturally. Comparison of these belief complexes with dominant Western themes about gender, as reflected in Western history, in contemporary ideological struggles, and most especially, in gender origin myths constructed by Western social scientists. C-L: Women's Studies. One course. *Quinn*

**114. Gender Inequality. (SS)** Universalistic theories of gender inequality posited on biological sex differences and differences in early psychological experience. Evolutionary theories that point to the existence of egalitarian societies and the appearance of gender inequality only with the emergence of ranking, stratified societies. The rise of the state; examination of the form of gender inequality in state societies. C-L: Comparative Area Studies and Women's Studies. One course. *Quinn*

**118S. The Language of Advertising. (SS)** Topics include: history and development of the genre of advertising language; comparisons to the specialized language used in medical, legal, and other professional contexts; and relation of topics to sociolinguistic theories and anthropological field methods. Primary focus on American television, print, and radio advertising and consideration of advertising language in certain other cultures. Directed field projects. Prerequisite: Cultural Anthropology 110 or consent of instructor. C-L: Linguistics. One course. *O'Barr*

**119. Language, Culture, and Society. (SS)** Analysis of language behavior within and across societies relating variations in linguistic usage to sociocultural factors: ethnosemantics, social dialects, and ethnography of speech. Prerequisite: Cultural Anthropology 94. C-L: Comparative Area Studies and Linguistics. One course. *Apte or Weller*

**121. China: Tradition and Transformation. (CZ)** Culture and social life in late imperial China; continuation and transformation in the twentieth century. Topics include religion, kinship and family, the position of women, imperialism, economic change in Taiwan, and the revolution. C-L: Comparative Area Studies. One course. *Weller*

**122. Modern Africa. (CZ)** Indigenous cultures and societies of Africa through the study of kinship, politics, economics, religion, and sociocultural change. Prerequisite: Cultural Anthropology 94. C-L: Comparative Area Studies. One course. *O'Barr*

**124S. The American Indian. (CZ)** The Indians of North and South America; origins and prehistory, archaeology, racial affiliations, languages, material culture, social and political organization, economics, and religion. C-L: Comparative Area Studies. One course. *Staff*

**125. Strategies of Comparative Analysis. (SS)** See C-L: Comparative Area Studies 125; also C-L: History 137, Political Science 125, and Sociology 125. One course. *Staff*

**126. Middle East: Wars, Revolutions, and Social Change. (CZ)** Political and institutional consequences of different forms of social relations. Topics include male-female relations, tribalism, traditional and experimental forms of family organization, ethnic and national identities and conflicts, and the impact of colonialism and the modern world system on the region. C-L: Comparative Area Studies and Women's Studies. One course. *Domínguez*

**127. Social Transformations in Central America. (CZ)** Current issues affecting the peoples of Central America in historical and anthropological perspective; analysis of revolution through the development of distinctive social structures and cultural forms. C-L: Comparative Area Studies. One course. *Smith*

**128. Caribbean Societies and Cultures. (CZ)** Social, economic, and political development within the world system; social differentiation, cultural fragmentation, colonialism, and dependence; the effects of slavery; and the Caribbean diaspora. C-L: Comparative Area Studies. One course. *Domínguez*



**130. Social and Cultural Change. (SS)** Contemporary theories of change, including innovation, acculturation, and modernization. Prerequisite: Cultural Anthropology 94. One course. *O'Barr or Smith*

**131. Socialism and Society in China. (CZ)** The People's Republic of China since 1949: socialist economic development, political life, population control, local community organization, the arts, and dissidence. C-L: Comparative Area Studies and Women's Studies. One course. *Weller*

**137. Incest, Adultery, and Other Problems in Kinship and Marriage. (SS)** Cross-cultural attitudes on human sexuality. Varieties of family life and its integration in the political and economic context of human societies. Prerequisite: Cultural Anthropology 94. C-L: Women's Studies. One course. *Domínguez or Quinn*

**139. Marxism and Society. (SS)** A critical appraisal of Marxism as a scholarly methodology for understanding human societies. The basic concepts of historical materialism, as they have evolved and developed in historical contexts. Topics include sexual and social inequality, alienation, class formation, imperialism, and revolution. Core course for the program in Perspectives on Marxism and Society. C-L: Education 139, History 186, Interdisciplinary Course 139, and Sociology 139. One course. *Fox or Wilson*

**141. The Self and Others: Ethnic, Racial, and Social Classifications. (SS)** The nature of human social identities, the contexts in which they are shaped, and the processes by which they change; emphasis on ethnic, racial, and gender identities. C-L: Women's Studies. One course. *Domínguez*

**145. Medical Anthropology. (SS)** Evolution and disease; theories of disease and healing; and factors influencing behavior in health and illness. One course. *Weller*

**147, 148. Introduction to Islamic Civilization. (CZ)** See C-L: Interdisciplinary Course 162, 163; also C-L: Comparative Area Studies; History 101G, 102G; and Religion 162, 163. One course each. *Lawrence and staff*

**151. Culture and Thought. (SS)** The role of culture in the organization of knowledge for the performance of everyday cognitive tasks and of thematic knowledge for the broader purposes of living, such as understanding oneself and others' behavior and pursuing one's life goals. One course. *Domínguez or Quinn*

**152S. Food in Cross-Cultural Perspectives. (SS)** The behavioral, institutional, linguistic, religious, and ideological aspects in relation to the production, distribution, and consumption of food within and across cultures. C-L: Comparative Area Studies. One course. *Apte*

**155. Anthropological Approaches to Religion. (SS)** Cross-cultural perspectives on the relationship of religion to experience, behavior, conflict, and change. C-L: Comparative Area Studies. One course. *Weller*

**158S. Cross-Cultural Studies of Humor. (SS)** Sociocultural basis, nature, scope, and function of humor. Prerequisite: Cultural Anthropology 94. One course. *Apte*

**163. Foundations of Chinese Civilization. (CZ)** The contemporary experience in China and its relation to ethnic, spiritual, social, aesthetic, moral, political, and economic themes in China's past. (Taught in China.) C-L: Comparative Area Studies and History 163. One course. *Staff*

**166. Introduction to Archaeology: Humans and Culture. (SS)** Modern methodology and analysis, theories of cultural evolution, and survey of world prehistory with an exploration of the uses of ethnographic analogy. One course. *Staff*

**167. Prehistoric Technology. (SS)** Procurement of raw materials, manufacturing of objects, and the usage of these objects in archaeological context. One course. *Staff*

**168. Beginnings of Civilization. (CZ)** Cultural developments from the beginning of agriculture to the rise of civilization in Africa, Mesoamerica, Peru, India, Southwest Asia, and China, using archaeological and ethnographic examples. C-L: Women's Studies. One course. *Staff*

**173. Revolutions in Latin America. (CZ)** Social, economic, political, and ideological circumstances that generate revolutions in twentieth-century Latin America. Prerequisite: consent of instructor. C-L: Comparative Area Studies. One course. *Smith*

**180. Current Issues in Anthropology. (SS)** Selected topics in methodology, theory, or area. One course. *Staff*

**180S. Current Issues in Anthropology. (SS)** Same as Cultural Anthropology 180 except instruction is provided in seminar format. One course. *Staff*

**193. Independent Study.** Directed reading and research. Open only to qualified seniors, with consent of Director of Undergraduate Studies. One course. *Staff*

**195S, 196S. Senior Seminar.** Prerequisites: Cultural Anthropology 94, a 100-level course in anthropology, and consent of Director of Undergraduate Studies. One course each. *Staff*

### For Seniors and Graduates

**201S. Marxism and Anthropology. (SS)** The interaction of Marxist and anthropological theory over the last half century; particular attention to evolution, historical transformation, mode of production, labor processes, culture, ideology, and consciousness. One course. *Smith*

**206S. Current Theoretical Schools in Anthropology. (SS)** The theoretical schools since World War II, including cultural materialism and neo-Marxism, structuralism, cognitive anthropology, cultural analysis and symbolic anthropology, transactional analysis, and sociobiology. Prerequisite: Cultural Anthropology 94 or graduate standing or consent of instructor. One course. *Apte, Domínguez, Fox, O'Barr, Quinn, Smith, or Weller*

**211S. Ethnography of Communication. (SS)** History of the mutual influence of linguistics and anthropology leading to the development of ethnography of speaking, ethnosciences, structuralism, and sociolinguistics. Topics vary each semester. Prerequisite: Cultural Anthropology 107 or 119. C-L: Linguistics. One course. *Apte, Domínguez, Fox, O'Barr, Quinn, Smith, or Weller*

**239. Culture and Ideology. (SS)** Major theories about the relation between ideologies and social/economic systems. Readings from the works of Marx, Weber, Gramsci, Althusser, Geertz, and others. C-L: Comparative Area Studies. One course. *Weller*

**241. The Rise of Civilization in Mesopotamia and Iran. (CZ)** An introductory survey of the major stages of development from the beginnings of agriculture to the collapse of the early state-system (10,000-1,800 B.C.E.). Archaeological and textual evidence, focusing on the rise of the Mesopotamian state-system, the nature of that system, and the mechanisms leading to its collapse. C-L: Women's Studies. One course. *Staff*

**243S. Theory and Method in Archaeology. (SS)** Techniques of geochronology, environmental reconstruction, sociocultural reconstruction, and statistical analyses applied to problem areas in archaeology. Prerequisite: Cultural Anthropology 166. One course. *Staff*

**251S. American Marriage: A Cultural Approach. (SS)** Individual research on the American cultural model of marriage. Collection, transcription, and analysis of how individuals adapt it to understanding their own experiences. C-L: Women's Studies. One course. *Quinn*

**255S. Heroes and Heroics: Culture and the Individual. (SS)** Can great men or women change the course of cultures? Or are even those we call geniuses and heroes simply carriers of their culture? The relationship between individuals and their cultures as portrayed in anthropology and related disciplines. Various approaches to the lives of selected heroes, using M. K. Gandhi as an exemplar. C-L: Comparative Area Studies. One course. *Fox*

**258S. Symbols in Society. (SS)** Symbolic action and expressive culture among tribal, peasant, and industrial societies. Approaches emphasized are functionalism, symbolic interaction, structuralism, and cultural interpretation. One course. *Domínguez or Weller*

**267. Cognitive Anthropology. (SS)** The organization of culturally shared knowledge; cognitive tasks such as categorizing, decision making, problem solving, and reasoning. One course. *Quinn*

**272S. Marxism and Feminism. (SS)** Introduction to the theoretical literature and debates linking Marxism and feminism. Prerequisite: consent of instructor. C-L: Women's Studies. One course. *Smith*

**280S, 281S. Seminar in Selected Topics.** Special topics in methodology, theory, or area. Prerequisite: consent of instructor. One course each. *Staff*

**282S. Canada. (SS)** See C-L: History 282S; also C-L: Canadian Studies, Comparative Area Studies, Interdisciplinary Course 282S, Political Science 282S, and Sociology 282S. One course. *Cahow*

**284S. Feminist Theory and the Social Sciences. (SS)** See C-L: Interdisciplinary Course 284S; also C-L: History 284S, Political Science 264S, Psychology 284S, Sociology 284S, and Women's Studies. One course. *Chafe, Neuschel, O'Rand, C. Smith, or Spenner*

#### **COURSES CURRENTLY UNSCHEDULED**

**99. Perspectives in Archaeology. (CZ)**

**101, 102. Introduction to the Civilizations of Southern Asia. (CZ)**

**105. History of Anthropology. (SS)**

**111. Anthropology of Law. (SS)**

**116. Language, Ethnicity, and New Nations. (SS)**

**120. South Asia: Institutions and Change. (CZ)**

**123. Societies of Mediterranean Europe. (CZ)**

**129. The Black Experience in the Americas: Roots and Directions. (CZ)**

**133. The Effects of Colonialism and Neocolonialism on Native Peoples. (SS)**

**134. Political Anthropology. (SS)**

**135. American Culture: Research and Analysis. (SS)**

**136S. Cross-Cultural Studies of Socialization. (SS)**

**140. The Anthropology of Race. (SS)**

**142. Anthropology and Cultural Bias. (SS)**

**156. The Politics of Ritual Performance. (SS)**

**159. Language and the International Order. (SS)**

**160S. Anthropology and Literature. (SS)**



- 164. Peasantry and Peasant Movements. (SS)
- 165. Psychological Anthropology. (SS)
- 170. Economic Anthropology. (SS)
- 189. The Americas: A Survey of the Forces Shaping the Hemisphere. (SS)
- 204S. The Anthropology of Cities. (SS)
- 205. The Anthropology of Anthropology. (SS)
- 215S. The Anthropology of Women: Theoretical Issues. (SS)
- 228S. Slavery and Society. (SS)
- 237S. Interpretations of Kinship. (SS)
- 275S. Inequality in Precapitalist Societies. (SS)

## THE MAJOR IN ANTHROPOLOGY

For a description of the anthropology major, see the section Anthropology.

## Dance

For courses in dance, see Institute of the Arts.

## Distinguished Professor Courses (DPC)

Distinguished professor courses enable students, regardless of their majors, to study with some of the most outstanding teachers and scholars within the University. The courses ordinarily focus on topics of broad intellectual and academic interest beyond the scope of a single discipline. They may count toward the appropriate distributional requirements.

**194S. Bach: Master of Style. (AL)** An approach to the "deepest thinking," the "most desirable of learning" of all the great composers. Works showing his unique ability to assimilate styles: including the *Brandenburg Concertos*, the *Passions*, and the *B minor Mass*. The complete *Well-tempered Clavier* is studied by the class and performed on the harpsichord by instructor. Prerequisite: ability to read music. C-L: Music 171S. One course. *Williams*

**195S. Geometry and Physics. (NS)** Relativity and general field theory from the point of view of differential geometry, to provide background for the modern gauge-field theories, including Yang-Mills theory, now prominent in mathematical physics. Prerequisites: advanced calculus and general physics, including electricity and magnetism. One course. *Griffiths*

**196S. Current Political Problems in Western European and Commonwealth Countries. (SS)** Prerequisite: consent of instructor. C-L: Comparative Area Studies. One course. *Cole*

**199S. The Changing Biosphere: Past, Present, and Future. (NS)** Interactions between changing global environments through time. The maintenance, evolution, and extinction of biotic systems, including communities. Special emphasis on the nineteenth, twentieth, and twenty-first centuries. Prerequisite: consent of instructor. C-L: Biology 199S. One course. *Billings*

**201. Dante's Inferno. (AL)** A close study of the text in a bilingual edition. Attention to the historical, political, and theological aspects of the poem. Examples of use of some of the cantos by Joyce, Eliot, and Beckett. One course. *Fowlie*

**202S. What It Means to Be Human. (SS)** What natural and humanistic sciences, and also philosophy and theology, have to say about the distinctive character of human beings. Prerequisite: junior or senior standing. One course. *Langford*

**203. Proust, *Remembrance of Things Past*. (AL)** In the three-volume translation by Kilmartin. The aesthetics of the novel in terms of its structure, characters, and social classes of France. Students who know French will be encouraged to do some of the reading in French. One course. *Fowlie*

**204S. Health Care Law and Policy. (SS)** How law shapes the performance of the health care industry. The tensions between quality and cost, professionalism and commercialism, and regulation and competition. Prerequisite: senior standing. One course. *Havighurst*

**205. The French Symbolists and T. S. Eliot. (AL)** A study of the poems and theory of Baudelaire, Mallarmé, and Rimbaud. The debt of the symbolists to Poe and their influence on Eliot. Taught in English. Bilingual texts will be used. One course. *Fowlie*

**207S. Topics in Psychobiology. (NS)** The biological substrates of human behavior in health and disease. Drug abuse, alcoholism, depression, schizophrenia, and human aggression. Films and videotapes. Student presentations; patient interviews. Prerequisites: senior standing and consent of instructor. C-L: Psychology 207S. One course. *Brodie*

## Drama Program (DRA)

Faculty of the Program: Artist-in-Residence Ball, *Director of the Drama Program*; Artist-in-Residence El Guindi, *Director of Undergraduate Studies*; Professors of the Practice of Theater Clum and Hobbs; Artists-in-Residence Fitzmorris, Judd, McAuliffe, St. Clair, and Worden; Adjunct Professor Azenberg; Instructors Kumin, O'Dor, and Young; Lecturer Banner. Affiliated faculty: Professors DeNeef (English), Jackson (English), Jameson (Romance Languages), A. Patterson (English), Randall (English), Stewart (Romance languages), Torgovnick (English), and G. Williams (English); Associate Professors Alt (Germanic languages), Burian (classical studies), Gopen (English), Jones (English), and Porter (English); Assistant Professors Gaines (English) and Moses (English); Lecturer Hill (English)

A major is available in this program.

The Drama Program applies two approaches: the artistic/creative, and the scholarly/theoretical. Using both approaches, the program either can provide a component of a liberal arts education, or, via intensive in-depth studio instruction, it can prepare highly-motivated, passionately interested students to pursue professional theater or screen activities. Classwork is primary, but complemented and extended by an array of student production activities and participation in professional stage and screen projects. The professional backgrounds and expertise of the resident faculty are augmented by those of a guest faculty of wide-ranging experience, from Broadway to Hollywood, from regional theater to television. The program's emphasis is on understanding and experiencing theater and screen as participatory, group art forms shaped by social, economic, technological, artistic, personal, and intellectual forces. The program—whether for the moderately interested student or the fervent, dedicated preprofessional—stresses the continual interdependence of these forces.

## INTRODUCTORY COURSES

**49S. Freshman Seminar.** Topics vary each semester offered. One course. *Staff*

**51. Introduction to World Theater. (AL)** Relationship of the history, arts, and crafts of theater to dramatic content and society. Primitive origins to Renaissance. Basics of text analysis. One course. *Ball and Clum*

**64. Drama of Greece and Rome. (AL)** See C-L: Classical Studies 64. One course. *Burian*

**65. Introduction to Film. (AL)** See C-L: English 81; also C-L: Film and Video. One course. *Gaines*

**71. Stagecraft.** Fundamentals of scenic technology: theater space, tools and hardware, lighting equipment, and reading of plans. Laboratory. One course. *Fitzmorris*

**81. Essentials of Public Speaking.** Basics of and practice in oral presentations, with particular attention to the gathering and organization of speech materials. For freshmen and sophomores. C-L: English 71. One course. *O'Dor or Hill*

**82. Essentials of Public Speaking.** Similar to Drama 81, but for juniors and seniors. Not open to students who have taken Drama 81 or English 71. C-L: English 72. One course. *O'Dor or Hill*

**83S. Argumentation.** Analysis, investigation, evidence, reasoning and refutation, and other communication strategies. Prerequisite: consent of instructor. C-L: English 73S. One course. *O'Dor*

**84. Interpersonal Communicative Behavior.** Study of the verbal and nonverbal communicative behavior of individuals involved in dyadic, face-to-face interactions. Focus on self-concept, relational messages, turn-taking, gender, and communication, among other interpersonal concepts. One course. *O'Dor*

**85. Small Group and Interview Communicative Behavior.** Verbal and nonverbal communicative processes of small group interaction and interviewing. Theory, research, and practical application. Open to juniors and seniors only. One course. *O'Dor*

**99S. Introduction to Acting. (AL)** The development of creativity by exploring the use of the imagination through improvisation and theater games. For nonmajors and beginning majors. Not open to students who have taken Drama 101. One course. *Staff*

## OTHER UNDERGRADUATE COURSES

**101S. Acting: Theory and Practice I. (AL)** Fundamental concepts and performance skills; beginning scene study. (Drama 71 may be taken concurrently with Drama 101.) Prerequisites: Drama 71 and consent of instructor. One course. *Hobbs*

**102S. Acting: Theory and Practice II. (AL)** Continuing scene study, emphasizing analysis and character. Prerequisites: Drama 101 and consent of instructor. One course. *Hobbs*

**103. Acting: Theory and Practice III. (AL)** Advanced scene study. Elements of style. Open to drama majors only. Prerequisites: Drama 51 or Drama 151, Drama 102, and consent of instructor. One course. *Hobbs*

**104. Acting: Theory and Practice IV. (AL)** Continuing advanced scene study and style. Audition preparation. Prerequisites: Drama 103 and consent of instructor. One course. *Hobbs*

**105. Voice and Speech.** Vocal production and articulation. Phonetics, control, emotional response, projection, placement, and awareness of regionalisms. Prerequisite: Drama 101. One course. *Staff*

**106. Voice and Speech II.** Advanced technique work. Open only to drama majors in the advanced studies sequence. Prerequisites: consent of instructor and Drama 105. One course. *Staff*

**107. Movement.** Applied body mechanics, tension release, breath, energy flow, relaxation, emotional response, alignment, and physical articulation. One course. *Staff*



**108. Movement II.** Advanced technique work. Open only to drama majors in the advanced studies sequence. Prerequisites: consent of instructor and Drama 107. One course. *Staff*

**111S. Playwriting I. (AL)** Fundamentals of writing for stage and screen. Prerequisites: a practical theater course (for example, acting, directing, design, stagecraft), and consent of instructor. C-L: English 107S and Film and Video. One course. *Ball and El Guindi*

**112S. Playwriting II. (AL)** Advanced projects in writing for production. Prerequisites: Drama 111S, and 99 or 101 or 181S, and consent of instructor. C-L: English 108S and Film and Video. One course. *Ball and El Guindi*

**113S. Screenwriting. (AL)** Advanced writing projects for feature film. Study of existing scripts and videos, application of techniques. Prerequisites: Drama 111 and consent of instructor. One course. *Ball*

**115, 116. Shakespeare. (AL)** See C-L: English 143, 144; also C-L: Medieval and Renaissance Studies. One course each. *DeNeef, Gopen, Jackson, Jones, A. Patterson, Porter, Randall, or G. Williams*

**118. Absurdist and Postmodern Drama. (AL)** One course. *Clum*

**119. The Political Stage. (AL)** See C-L: Literature 119. One course. *Clum*

**120. Twentieth-Century American Drama. (AL)** See C-L: English 162. One course. *Clum*

**121. Modern British Drama. (AL)** See C-L: English 133. One course. *Clum or Moses*

**122. French Comedy. (AL, FL)** See C-L: French 151. One course. *Stewart*

**123. French Drama of the Twentieth Century. (AL, FL)** See C-L: French 162. One course. *Staff*

**124S. Drama (German). (AL, FL)** See C-L: German 115S. One course. *Alt*

**126. French Drama of the Seventeenth Century. (AL, FL)** See C-L: French 148; also C-L: Medieval and Renaissance Studies. One course. *Staff*

**131S. Film and Video Theory and Practice. (AL)** Prerequisite: Drama 65, English 81, or Literature 177. See C-L: English 183S; also C-L: Institute of the Arts 115S. One course. *Staff*

**135. Narrative Film and the Novel. (AL)** See C-L: English 188; also C-L: Film and Video. One course. *Clum, Gaines, Moses, or Torgovnick*

**136. Studies in Film History. (AL)** See C-L: English 185; also C-L: Film and Video and Literature 187. One course. *Clum, Gaines, Jameson, or Moses*

**137. Melodrama and Soap Opera. (AL)** See C-L: English 187. One course. *Clum or Gaines*

**138. American Film Genres. (AL)** See C-L: English 182; also C-L: Film and Video. One course. *Clum, Gaines, or Moses*

**139. Television, Technology, and Culture. (AL)** Prerequisite: Drama 65, English 81, or Literature 177. See C-L: English 190. One course. *Gaines*

**140S. Theater Forum.** Topics for study and evaluation include: artistic and professional conventions and standards; current theater issues; future educational and career options; portfolios and resumes; analysis and evaluation of student's own current theater work; other areas of educational and procedural importance for advancing theater students. Prerequisite: junior drama major or consent of instructor. Half course. *Ball and Hobbs*

**141. Production and Internship.** Practical involvement in four different areas of Drama Program productions, attendance at Drama Program symposia, participation in senior drama major projects, and completion of an approved internship or Duke Summer Drama Institute. Course requirements may be satisfied in any year, but only seniors register. Offered only on the pass/fail basis. Prerequisite: Drama 140S. No credit. *Staff*

**145S. Theater Farce. (AL)** Farce as a genre in its onstage context. Aristophanes, Plautus, medieval interludes, Shakespeare, Goldoni, Feydeau, Chekhov, Orton, and others. C-L: English 171S. One course. *El Guindi*

**146S. Canadian Theater. (AL)** Development and current state of Canada's dramatic literature and theater activity. Dramatic topics, styles, trends, administrative and support systems, the roles of theater in society, and comparisons of these factors in the United States and Western Europe. Guest lectures by Canadian playwrights and other theater artists, and by non-Canadians with substantial involvement with Canadian theater. C-L: Canadian Studies and English 184S. One course. *Ball*

**147S. Southern Playwrights. (AL)** The work of Southern playwrights in the context of Southern literature, environment, culture, and language; how these considerations affect the creation of work for the stage; traditional and contemporary works. One course. *Banner*

**148. Text and Performance. (AL)** (London summer program.) See C-L: English 181. One course. *Clum*

**149. Drama and Society. (AL)** (London summer program.) See C-L: English 134. One course. *Clum*

**151. World Theater: Advanced. (AL)** Intensive investigation of the history, arts, and crafts of theater and their relationship to dramatic content and theory and to society. Renaissance to present. C-L: English 174. One course. *Clum*

**161. Stage Costuming.** Survey of skills and techniques of design and construction. History, textiles, crafts, millinery, and aesthetics. Laboratory. One course. *Worden*

**162. Costume Design I.** Design principles applied to visualizing character and relationships. Periods and styles. One course. *Worden*

**163. Costume Design II.** Advanced applications. Prerequisite: Drama 162. One course. *Worden*

**164. Advanced Costume Construction.** Pattern draping, finishing, dyeing. Laboratory. Prerequisite: Drama 161 or consent of instructor. One course. *Worden*

**165. Costume and Scene Design Rendering.** Drawing and painting fundamentals for readable renderings. One course. *Worden*

**166. Costume History. (CZ)** Relationship of clothing to culture and society from ancient Egypt to the present. One course. *Worden*

**167. Make-Up: Theory and Practice.** Design and execution. Methods, materials, special problems, and projects. Laboratory. Half course. *Worden*

**168. Drawing and Rendering.** Fundamentals of representational drawing using eye training methods. One course. *Worden*

**170. Design and Color.** Applications of theory to scenery, costumes, and lighting; emphasis on graphic presentation. Laboratory. Prerequisites: Drama 71 and one of the following—Drama 168, Art 53, or consent of instructor. One course. *Staff*

**171. Advanced Stagecraft.** Advanced methods and tools of scenic technology; emphasis on drafting, construction, and contemporary materials. Laboratory. Prerequisite: Drama 71. One course. *Fitzmorris*

**172. Scenery Design I.** Application of aesthetics, skills, and theory to scenic design; emphasis on design projects. Laboratory. Prerequisite: Drama 170 or consent of instructor based on portfolio review. One course. *Judd*

**173. Scenery Design II.** Advanced applications. Prerequisite: Drama 172. One course. *Judd and staff*

**177. Lighting: Theory and Practice.** History, fundamentals of electricity, instrumentation, and drafting light plots. Laboratory. Prerequisite: Drama 71 or consent of instructor. One course. *Judd*

**178. Lighting Design.** Advanced application of aesthetics and technique to lighting design, emphasizing design projects. Laboratory. Prerequisites: Drama 170, Drama 177, and Drama 168 or Art 53 or consent of instructor. One course. *Judd*

**181S. Directing: Theory and Practice I. (AL)** History, aesthetics, and fundamental techniques of directing. (Drama 51 may be taken concurrently with Drama 181S.) Prerequisites: Drama 51, 99 or 101, and consent of instructor. One course. *McAuliffe*

**182S. Directing: Theory and Practice II. (AL)** Advanced application of aesthetics, skills, and theory to performance projects. Prerequisite: Drama 181S. One course. *McAuliffe*

**185S. Theater Administration.** History and principles of running the theater and managing the production. Emphasis on theater organization, theater types (commercial, not-for-profit, regional), and involvement with other entities (unions, investors, philanthropic bodies). One course. *Kunin and staff*

**191, 192, 193, 194. Independent Study.** Individual intensive research or creative projects. Half or one course. Prerequisite: consent of instructor. Variable credit. *Staff*

**195, 196. Special Topics.** Illustrative examples: specific writers or other theater artists, media studies, styles, mime, masks, clowns, stage fighting, newspaper criticism, studies of the profession, audition techniques, and theater periods. May be taken more than once. Half course, one course, respectively. *Staff*

**195S, 196S. Special Topics.** Seminar versions of Drama 195 and 196. May be taken more than once. Half course, one course, respectively. *Staff*

**197S. Special Topics in Film. (AL)** See C-L: English 189S; also C-L: Film and Video. One course. *Clum, Gaines, or Moses*

## COURSES CURRENTLY UNSCHEDULED

**220S. Drama (German). (AL, FL)**

## THE MAJOR

Majoring in drama is a means of (1) acquiring a comprehensive knowledge of the field, (2) learning the skills, discipline, and dedication inseparable from theater and screen pursuits, and (3) becoming aware of the relationship of every field of knowledge to stage and screen activities. Drama majors are expected to demonstrate continual visible growth in each of these areas, and this most especially requires the development of professional attitudes, behavior, and responsibility. Thus, deep intellectual involvement and extraordinary passion are crucial prerequisites.

(1) **Theater Sequence** (for students interested primarily in live theater).

*Prerequisites:* Drama 51 and 71.

*Requirements:* Drama 99 or 101, 140S, 141, 151, 161 or 172, 181S, 185, and two approved dramatic literature courses.

(2) **Theater and Screen Sequence** (for students interested in both live theater and film and video).



*Prerequisites:* Drama 51 (or 151), 65, and 71.

*Requirements:* Drama 99 or 101, 131, 140S, 141, 181S, plus two courses in Drama 195, 196 (Special Topics: for example, screen acting, directing, writing, producing, design) plus two approved courses in film or video history, criticism, or analysis.

*Advanced Studies:* Students intending to pursue graduate or professional theater or screen work may choose to take best advantage of the program's offerings via an advanced sequence of five approved Drama Program and related courses.

*Note:* The Drama Program's screen studies are distinct from those of the Film and Video Program. Screen studies in the Drama Program emphasize creative application and production, with an academic component. The Film and Video Program emphasizes history, theory, and criticism, with a production component. Students may pursue both. See listing under Film and Video Program.

## Economics (ECO)

Professor Vernon, *Chairman*; Professor Grabowski, *Director of Undergraduate Studies*; Professors Clotfelter, Cook, Davies, de Marchi, Geweke, Gillis, Goodwin, Graham, Havrilesky, Kelley, Kreps, Krueger, McElroy, Naylor, Tauchen, Tower, Treml, Viscusi, Wallace, Weintraub, and Yohe; Associate Professors Kimbrough and Marshall; Assistant Professors Baumgardner, Brock, and Meurer; Instructor Pessino; Adjunct Professors Bates, Gallant, Ladd, and Richard; Research Professors Coats, Henderson, and Hendry

A major is available in this department.

Economics courses develop the critical and analytical skills essential for understanding economic problems and institutions, in both their contemporary and historical settings. Although no particular vocational or professional goal is emphasized, these courses provide the academic background necessary for positions in industry, for work in many branches of government service, for law school, and for graduate study in business administration, economics, and the social sciences.

Students planning to do graduate work in economics are advised to take as many of the following courses in mathematics (listed in preferential order) as their schedules permit: Mathematics 31, 32, 103, 104, 131, 135, and 136.

**1. National Income and Public Policy. (SS)** Basic economic analysis emphasizing current public policy issues. Means of determining the level and rate of growth of aggregate national income and output. Causes of unemployment, inflation, and international payment problems. The effects of monetary policy (money supply and interest rates) and fiscal policy (government expenditures and taxes) on these problems. Open only to freshmen. One course. *Staff*

**1D, 2D. (SS)** The same courses as Economics 1, 2 except taught as lectures with discussion sections. One course each. *Staff*

**2. Competition, Monopoly, and Welfare. (SS)** The composition of output and the distribution of income in a market economy. Role of government. Contemporary problems of the environment. Topics such as environmental economics, monopoly, unionism, international trade. Comparison of a market economy with other systems of economic organization. Economic problems of developing countries. Open only to freshmen. One course. *Staff*

**49S. Freshman Seminar.** Topics vary each semester offered. One course. *Staff*

**51. National Income and Public Policy. (SS)** See Economics 1. Open to all students. One course. *Staff*

**51D, 52D. (SS)** The same courses as Economics 51, 52 except taught as lectures with discussion sections. One course each. *Staff*

**52. Competition, Monopoly, and Welfare. (SS)** See Economics 2. Open to all students. One course. *Staff*

**53. Economics of Contemporary Issues. (SS)** Modern economic problems, such as environmental deterioration and urban decay. The market as one of the interrelated sub-systems of the social system, from institutionalist, Marxist, and other perspectives in the social sciences. One course. *Staff*

**108. Economics of War. (SS)** Conflict theory, causes and economic consequences of war, military personnel, military-industrial complex, disarmament, and the economy. Prerequisite: Economics 52. One course. *Weintraub*

**114. Social Choice. (SS)** The economic study of nonmarket decision making. Theory of constitutions, voting rules, voter behavior, the bureaucracy, incentives for reaching consensus, and the evolution of cooperation. Applications to the provision of public goods, and tax policy and redistribution. Available only in the Duke in Amsterdam Summer Program. Prerequisite: Economics 1 or 51, 2 or 52. One course. *de Marchi*

**132. Introduction to Economic History. (SS)** A survey of Western economic history: population, production, exchange, and institutions; from antiquity to the present. Prerequisite: Economics 52 or consent of instructor. One course. *Staff*

**133. The Evolution of the American Economy. (SS)** The process of industrialization and modernization in the United States from the pre-Civil War period to the present. Prerequisites: Economics 51 and 52. One course. *Coats*

**135. The Dutch Economy. (SS)** Analysis of social and economic policy-making in the Netherlands. The recent history and theory of state intervention; the ideology, institutional context and machinery of social consensus in the areas of taxation, labor markets, incomes policy, industrial policy, energy, housing, education, health care, and national insurance. Available only in the Duke in Amsterdam Summer Program. One course. *de Marchi*

**139. Introduction to Econometrics. (SS)** Data collection, estimation, and hypothesis testing. Use of econometric models for analysis and policy. Prerequisites: Economics 2 or 52 and Mathematics 32 or equivalent and Statistics 10D or equivalent. One course. *Marshall, McElroy, Tauchen, or Wallace*

**149. Microeconomic Theory. (SS)** Cost and supply considerations in price theory; the demand for factors of production. The allocation of resources in the context of competitive and monopolistic market structures. Not open to students who have had Public Policy Studies 110. Prerequisites: Economics 2 or 52 and Mathematics 31. One course. *Graham, McElroy, Pessino, Treml, Vernon, or Wallace*

**150. History of Economic Thought. (SS)** Approaches to economic problems from Aristotle to Keynes, emphasizing certain models and doctrines—their origins, relevance, and evolution. Readings from Mun, Quesnay, Adam Smith, Malthus, Ricardo, Marx, Walras, Veblen, and Keynes. C-L: Comparative Area Studies. One course. *de Marchi or Goodwin*

**153. Monetary Economics. (SS)** The evolution and operations of commercial and central banking and nonbanking financial institutions in the United States, the determination of monetary aggregates and interest rates, the financial impacts of Treasury operations, and the linkages from Federal Reserve actions to price level, employment, economic growth, and balance of payments objectives. Prerequisite: Economics 154. One course. *Brock, Havrilesky, or Yolie*

**154. Aggregate Economics. (SS)** Concepts and measurement of national income and expenditures, employment, interest rates, and price levels; the theoretical determination of these aggregates; applications of macroeconomic theory to business cycles and

economic growth. Prerequisites: Economics 1 or 51 and 2 or 52 and Mathematics 31. One course. *de Marchi, Havrilesky, Kimbrough, Tauchen, Tower, or Yohe*

**155. Labor Economics: Analysis and Measurement. (SS)** Labor market equilibria. The demand for labor. The supply of labor: human fertility, human capital, hours of work, and labor force participation. Wage levels and differences. Union and government as labor market factors. Prerequisites: Economics 149, Mathematics 31, and statistics. One course. *Baumgardner or Pessino*

**157S. Business Cycles and Economic Forecasting. (SS)** Causes of fluctuations in economic activity and conventional methods of forecasting micro- and macroeconomic variables, using microcomputer programs. Forecasting projects by students. Prerequisites: Economics 149, 154, and statistics. One course. *Yohe*

**159. State and Local Public Policy. (SS)** Does not count for economics major requirements. Prerequisite: Economics 149, Public Policy 110, or consent of instructor. See C-L: Public Policy Studies 159. One course. *Staff*

**180. Law and Economics. (SS)** An introduction to the economic analysis of legal issues and legal reasoning. Case studies in accident law, product liability, and the value of life. Other topics include contracts, property, affirmative action, civil procedure, and the economics of criminal behavior. Prerequisite: Economics 149. One course. *Viscusi*

**184. An Introduction to Canada and Canadian Issues. (SS)** Does not count for economics major requirements. See C-L: Interdisciplinary Course 184; also C-L: Canadian Studies, Comparative Area Studies, History 184, Political Science 184, and Sociology 184. One course. *Cahow*

**187. Public Finance. (SS)** Economic aspects of such problems as the growth of government, the proper role of the state, the centralization and decentralization of government, government bureaucracy, the impact of taxes and spending on the wealthy and the poor, other public policies and questions. Prerequisite: Economics 149. One course. *Davies*

**189. Business and Government. (SS)** Public policies which most directly affect the operation of competition in the business world. The economic basis for an evaluation of antitrust policy, public utility regulation, and public enterprise. Prerequisites: Economics 149 and statistics, or consent of instructor. One course. *Grabowski, Marshall, or Vernon*

**191, 192. Independent Study.** Directed reading and research. Prerequisites: consent of instructor and Director of Undergraduate Studies. One course each. *Staff*

**193, 194. Independent Study.** Same as Economics 191, 192, but for seniors. One course each. *Staff*

### For Advanced Undergraduates and Graduates

**200. Capitalism and Socialism. (SS)** Selected ideological classics of new and old, right and left economics including both "counsels for perfection" (utopias) and "precepts for action" in political economy. Prerequisites: Economics 149 and 154 or consent of instructor. One course. *Naylor*

**203S. Mathematical Economics. (SS)** Selected mathematical tools from symbolic logic, naive set theory, linear algebra, calculus, analysis, and elementary topology applied to the analysis of economic problems. Topics include consumer choice, production, general equilibrium, and growth. Prerequisites: two courses in college calculus and Economics 149. One course. *Graham*

**205S. Advanced Monetary Theory and Policy. (SS)** Emphasis on recent issues: innovations in the payments mechanism and new monetary aggregates, the subterranean economy, financial crises, alternative views of the monetary policy transmission mech-



anism, and the monetarist-fiscalist controversy. Prerequisite: Economics 153. One course. *Havrilesky or Yohe*

**212S. Economic Science and Economic Policy. (SS)** A historical examination of the impact of economics on public policy; topics vary each semester and have included energy and anti-inflation policy, productivity growth, the Third World, and the Council of Economic Advisers. One course. *Goodwin or Henderson*

**214. Social Choice. (SS)** A nonseminar version of 214S. Same as 114 but requires additional major research paper. Available only in the Duke in Amsterdam Summer Program. Prerequisite: Economics 1 or 51, 2 or 52. One course. *de Marchi*

**218. Macroeconomic Policy. (SS)** Does not count for economics major requirements. See C-L: Public Policy Studies 218. One course. *Staff*

**219S. Economic Problems of Underdeveloped Areas. (SS)** Analysis of underdeveloped countries with some attention to national and international programs designed to accelerate development. Prerequisite: Economics 149 or consent of instructor. C-L: Comparative Area Studies. One course. *Kelley or Naylor*

**220S. Computer Modeling for Policy Analysis. (SS)** Introduction to the use of computer techniques in economic policy evaluation; policy applications to international economics, public finance and development economics; computer analysis of linear and nonlinear models. Students required to complete a major modeling project. Prerequisites: Economics 149 and Economics 154. One course. *Tover*

**232. Microeconomics: Policy Applications. (SS)** Does not count for economics major requirements. See C-L: Public Policy Studies 232. One course. *Gillis*

**233. Public Sector Economics and Policies. (SS)** Analysis of expenditures, taxation, debt, public enterprises, and current government programs. Prerequisite: Economics 149 or consent of instructor. One course. *Davies*

**239. Introduction to Econometrics. (SS)** Same as 139 but requires additional term paper. (Not open to students who have had Economics 139.) Prerequisites: Economics 2 or 52 and Mathematics 32 or equivalent and Statistics 10D or equivalent. One course. *Marshall, McElroy, Tauchen, or Wallace*

**243. Econometrics I. (SS)** Economic theory, mathematics, statistical inference, and electronic computers applied to analysis of economic phenomena. Objective is to give empirical content to economic theory. Matrix algebra used to develop topics in inference, linear regression, and systems of simultaneous equations. Use is made of the electronic computer. Prerequisites: Economics 149 and Statistics 200 or equivalents. C-L: Statistics 243. One course. *Marshall or Wallace*

**244. Corporate Economics I. (SS)** Strategic planning models of the firm including marginal analysis, mathematical programming, portfolio, and corporate simulation models. Economics as the language of corporate planning and modeling. Prerequisites: Economics 149 and statistics, or equivalents. One course. *Naylor*

**245. Econometrics II. (SS)** Advanced theory and applications: includes specification error, generalized least squares, lag structures, Bayesian decision making, simultaneous equation methods, and forecasting. Emphasis on current applied literature. Prerequisite: Economics 243. C-L: Statistics 245. One course. *Geweke, McElroy, Tauchen, or Wallace*

**246. Selected Topics in Econometric Theory. (SS)** Analysis of panel data, combining data from different sources, vector autoregressive methods, problems of causation in time series data, nonlinear estimation, limited dependent variables, sample selection bias, and other topics to be chosen subject to the interests of the class. C-L: Statistics 246. One course. *Geweke, Hendry, Richard, Tauchen, or Wallace*

**247S. Applied Econometrics. (SS)** Application of current developments in econometric methodology to empirical problems in economics. Emphasis on the conduct of empirical research, including model and hypothesis formulation, testing, and integration of economic and econometric theory. C-L: Statistics 247S. One course. *Geweke, Marshall, McElroy, Tauchen, or Wallace*

**249. Microeconomics. (SS)** Similar to Economics 149 but at a more advanced level. Not open to students who have taken Economics 149. One course. *Staff*

**250S. Modern Economic Thought. (SS)** Major streams of economic analysis since 1936. Selected topics from the economics of Keynes, its offshoots and coordinate developments in monetary and equilibrium theory; post-Marxian economic theory. Historical evolution of recent ideas and their interrelations. Prerequisites: Economics 149, Economics 154, and statistics, or consent of instructor. One course. *de Marchi or Weintraub*

**254. Macroeconomics. (SS)** Similar to Economics 154 but at a more advanced level. Not open to students who have taken Economics 154. One course. *Staff*

**265S. International Trade and Finance. (SS)** Fundamental principles of international economic relations. The economic basis for international specialization and trade and the economic gains from trade, the balance of international payments, problems of international finance, investments, and monetary problems. Prerequisites: Economics 149 and 154. C-L: Canadian Studies. One course. *Brock, Kimbrough, Krueger, or Tower*

**268. Federal Tax Policy. (SS)** Does not count for economics major requirements. See C-L: Public Policy Studies 268; also C-L: Law 518. One course. *Clotfelter or Schmalbeck*

**270S. Fundamentals of Political Economy. (SS)** See C-L: Political Science 270S. One course. *Aldrich, Bates, or Bianco*

**286S. Economic Policy-Making in Developing Countries. (SS)** Does not count for economics major requirements. See C-L: Public Policy Studies 286S; also C-L: Comparative Area Studies. One course. *Gillis*

**287. Public Finance. (SS)** Same as 187 but requires additional term paper. Not open to students who have had Economics 187. Prerequisite: Economics 149. One course. *Davies*

**293. Soviet Economic History. (SS)** Establishment of foundations of a socialist economy: collectivization, industrialization, and search for economic efficiency. C-L: Comparative Area Studies. One course. *Trembl*

**294S. Soviet Economic System. (SS)** Economic planning and administration in the Soviet Union and other socialist countries. International comparisons. Theoretical and applied problems of resource allocation, economic development, and optimal micro decision making in a nonmarket economy. C-L: Comparative Area Studies. One course. *Trembl*

### Honors Seminars (by invitation only)

**201S, 202S. Current Issues in Economics. (SS)** Economic analysis of such issues as the health care system, crime and punishment, pollution and the environment, the performing arts, welfare, and the energy crisis. Prerequisites: for 201S, Economics 149 and statistics; for 202S, Economics 201S. One course each. *Davies*

**206S. Regulation and Industrial Economics. (SS)** Analysis of industrial competition and performance in industries such as automobiles, steel, agriculture, airlines, pharmaceuticals, computers, and cable TV. Analysis of the efficiency of regulation and other public policy programs. Prerequisites: Economics 149 and statistics. One course. *Grabowski*

**207S. Conflict and Cooperation in Economics. (SS)** Elements of game theory. Cooperative and noncooperative games with reference to trading, general equilibrium theory, oligopoly, and monopoly. Prerequisites: Economics 149 and Mathematics 103. One course. *Weintraub*

**208S. Economics of Labor Supply and the Family. (SS)** Supply of labor and returns to human capital over the life cycle; demand for labor and discrimination; sex and race differences in wage rates, hours of work earnings, occupation, and unemployment; specialization, conflict and cooperation, and the allocation of goods and leisure within a family; marriage and divorce; and fertility. Prerequisites: Economics 149 and statistics; Economics 139 is recommended. C-L: Women's Studies. One course. *McElroy*

**209S. Economics of Population. (SS)** Relationship of population growth to economic development and to natural resource and environmental pressures. Causes and impacts of population change, including economic models of fertility, mortality, marriage, and migration. Prerequisites: Economics 149 and 154. One course. *Kelley*

**213S. Economics of Slavery in the American South. (SS)** The nature, development, and economic and social consequences of slavery in the United States during the nineteenth century. Prerequisites: Economics 149 and consent of instructor. C-L: Afro-American Studies 213S. One course. *Coats*

#### **COURSES CURRENTLY UNSCHEDULED**

160. Resource Economics and Public Policy. (SS)

169, 170. Microeconomic Analysis I and II. (SS)

198S. Economics of Regulation. (SS)

204S. Advanced Monetary Economics. (SS)

211S. Current Problems in Aggregate Supply. (SS)

214S. Social Choice. (SS)

224S, 225S. Economics of the Law. (SS)

234. Urban and Regional Economics. (SS)

235. The Economics of Crime. (SS)

285. Evaluation of Public Expenditures. (SS)

#### **THE MAJOR**

**For freshmen matriculating in the fall 1986 semester, and thereafter:**

*Prerequisites.* Mathematics 31, Economics 1 or 51, and Economics 2 or 52, and an approved statistics course. (Statistics courses currently acceptable include Statistics 10 and 100 and Public Policy Studies 112.)

*Major Requirements.* Economics 149, 154, and any three additional 100- or 200-level courses. Substitution of similar courses in other departments for courses in the economics department will not be permitted.

**For all students matriculating before the fall 1986 semester:**

*Prerequisites.* Mathematics 31, Economics 1 or 51, and Economics 2 or 52.

*Major Requirements.* Economics 149, 154, and any three additional 100- or 200-level economics courses. Substitution of similar courses in other departments for courses in the economics department will not be permitted.

*Honors.* For graduation with distinction at least one honors seminar and an honors paper are required. Prerequisites for admission to an honors seminar are two of the fol-



lowing courses: Economics 149, 154, and an approved statistics course. See the section on honors in this bulletin.

## Education Program (EDU)

Associate Professor Davis, *Chairman and Director of Undergraduate Studies*; Professor Page; Associate Professors Ballantyne, Carbone, Di Bona, Johnson, and Sawyer; Adjunct Professor Eilber; Adjunct Associate Professor Martin; Adjunct Assistant Professor Mayesky; Part-time Instructor Peete; Lecturers Bryant, Fowler, and Malone

Students who desire an understanding of the study of education as part of their liberal arts program should elect courses in accordance with their special interests. Selected courses in education may satisfy requirements in the social sciences area of knowledge designation. Students who expect to teach should confer with an advisor in the program prior to registration each semester. Students interested in certification to teach in secondary schools should consult Professors Carbone, Davis, or Mayesky. For early childhood certification consult Professor Mayesky.

**49S. Freshman Seminar.** Topics vary each semester offered. One course. *Staff*

**100. Social and Philosophical Foundations of Education. (SS)** Basic features and assumptions, viewpoints, and issues of education in contemporary America. One course. *Carbone or Di Bona*

**103S. American Educational Theory. (SS)** A study of contemporary issues and problems. One course. *Carbone*

**108S. Early Childhood Language Arts. (SS)** Theories and programs for the development of reading, writing, speaking, and listening competencies in children. One course. *Staff*

**109S. Early Childhood Curriculum.** Seminar in curriculum development. Principles, practices, and problems of instruction. For student teachers only. One course. *Bryant or Mayesky*

**117S. Psychology of Personal and Social Adjustment. (SS)** Principles of mental health affecting individual and social adjustments. One course. *Malone or staff*

**118. Educational Psychology. (SS)** Emotional and cognitive learning in children, youth, and adults. One course. *Ballantyne, Davis, or Page*

**120. Early Childhood Education: Internship.** Supervised internship in an elementary school, involving full-time teaching. For student teachers only. Pass/fail grading only. Two courses. *Mayesky and staff*

**121. Infancy, Early Childhood, and Educational Programs. (SS)** Developmental theories and their practical application in education. Emphasis on parenting and teaching. One course. *Mayesky*

**139. Marxism and Society. (SS)** Core course for the Program in Perspectives on Marxism and Society. See C-L: Cultural Anthropology 139; also C-L: History 186, Interdisciplinary Course 139, and Sociology 139. One course. *Fox or Wilson*

**140. The Psychology of Work. (SS)** Factors affecting career choice and change. One course. *Ballantyne*

**149S. Exceptional Children. (SS)** Etiology and assessment of major types of exceptionalities, including intellectual abilities, physical or emotional handicaps, and sensorially impaired. Family relationships and treatment programs. One course. *Davis*

**155S. Tests and Measurements. (SS)** Measuring abilities, achievement, and personality. Analysis, criticism, and construction of tests for admission, classroom, and society. One course. *Page*

**189S. The Teaching of Composition, Grammar, and Literature in Secondary School.** See C-L: English 118S. One course. *Page*

**191, 192. Independent Study.** Directed reading and research for juniors. Prerequisites: consent of instructor and Director of Undergraduate Studies. One course each. *Staff*

**193, 194. Independent Study.** Directed reading and research for seniors. Prerequisites: consent of instructor and Director of Undergraduate Studies. One course each. *Staff*

#### **For Seniors and Graduates**

**205, 206. Selected Topics.** One course each. *Staff*

**215S. Seminar in Secondary School Teaching.** Principles, practices, and problems in secondary school instruction. One course. *Carbone or staff*

**216. Secondary Education: Internship.** Supervised internship in senior high schools, involving some full-time teaching. For student teachers only. Two courses. *Carbone or staff*

**225. Teaching of History and the Social Studies.** Evaluation of the objectives, content, materials, and methods in the teaching of history and the social studies. One course. *Carbone or staff*

**232. Learning and Living in Families.** Role and function of the family as related to the development and behavior of its members, to gender identification, to parenting, and to interactions among family members. One course. *Ballantyne or Davis*

**236. Teaching Developmental and Remedial Reading in the Secondary School.** Principles, methods, and materials for the development of effective reading attitudes and skills in developmental and remedial programs. One course. *Staff*

**242S. Group Interactions.** Examination of theoretical issues and processes involved in the dynamics of, and learning in, small groups of children, adolescents, parents, other adults, with attention to problem-oriented groups. One course. *Ballantyne*

**246. Teaching of Mathematics.** Aims, curriculum, and classroom procedure for teaching secondary school mathematics. One course. *Staff*

**276. The Teaching of High School Science.** Discussion, lectures, and collateral reading related to such topics as aims, tests, curriculum, classroom and laboratory procedures, field trips, and course and lesson planning for secondary school science. One course. *Staff*

#### **COURSES CURRENTLY UNSCHEDULED**

**168S. Contemporary Education Criticism. (SS)**

**170. The Undergraduate Curriculum**

**171T, 172T. Junior-Senior Tutorials**

**173, 174. Clinical Reading Practicum**

**211. Education and the Mass Media. (SS)**

**212S. Pedagogy and Political Economy: A World View. (SS)**

**227. Contemporary Theories of Counseling and Psychotherapy. (SS)**

**248. Practicum in Counseling**

## UNIVERSITY PROGRAM FOR PREPARATION FOR TEACHING\*

Duke University offers programs to prepare students to meet certification requirements for teaching in elementary and secondary schools although no major is offered in education. Prerequisites for all prospective teachers are an introductory course in psychology and Education 100 or 1035 or equivalent. Special methods courses should be taken in the education program and other appropriate departments prior to undergraduate student teaching, which is part of a planned professional semester in the senior year.

### Secondary School Teaching

Prospective secondary school teachers major in one of sixteen departments in Trinity College of Arts and Sciences. They are advised to consult an advisor in the Education Program concerning their interest in teaching and their completion of an application to be accepted in the teacher preparation program. Students preparing to teach in a secondary school must meet certification requirements by qualifying in one teaching field: English, mathematics, sciences, or social sciences. Qualifications for certification to teach a single science may be sought under either the Bachelor of Arts or the Bachelor of Science degree.

### Early Childhood Teaching

Undergraduate students who have the desire to teach young children (usually kindergarten through grade four), either in public or private schools, may qualify for a teaching certificate while at Duke in addition to completing their Trinity College majors. Completion of four elective courses and an intensive senior fall semester internship entitles students to early childhood teacher certification.

Interested undergraduate students should apply to the Early Childhood Program in the fall of the junior year. Students are selected by competitive criteria for participation in an intensive senior fall semester which links together a teaching internship in a model school, seminars, and independent directed research (four courses). Students selected for the early childhood teaching certificate program are placed as interns with master teachers in a model elementary school in a public school system, and supervised by a Duke professor on a one-to-one basis. Duke student interns begin their internship with the master teacher during preservice days before classes for children begin.

Upon completion of the senior year fall internship semester, and upon completion of the four-year Trinity College undergraduate degree, students may apply for early childhood teaching certification.

## English (ENG)

Professor Fish, *Chairman*; Professor Torgovnick, *Assistant Chairman*; Associate Professor Gerber, *Director of Undergraduate Studies*; Associate Professor Gopen, *Supervisor of Freshman Instruction and Director of University Writing Program*; Professors Anderson, Applewhite, Budd, DeNeef, Ferguson, Gleckner, Jackson, F. Lentricchia, Nygard, A. Patterson, L. Patterson, Price, Randall, Ryals, Sedgwick, B. H. Smith, G. Smith, Strandberg, Tompkins, G. Williams, and K. Williams; Associate Professors Butters, Clum, Jones, Mellow, Pope, Porter, and Schwartz; Assistant Professors Ferraro, Gaines, Moon, and Moses; Adjunct Associate Professor Ball; Adjunct Assistant Professors M. Lentricchia, Tetel, and Wittig; Instructor Cox; Lecturer Hill

A major is available in this department.

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\*Duke University is accredited by the North Carolina Department of Public Instruction and has reciprocal approval for initial certification with most of the fifty states.



## WRITING AND LANGUAGE

For courses in composition see below and also University Writing Courses 4, 5, 6, 7, 8, and 117S in the University Writing Program section of this bulletin.

**3. Introductory Composition and Literature.** A skills course in composition and literature (contemporary essays and short stories), with frequent writing assignments; regular individual conferences. (This course, offered in the Summer Transitional Program, does not satisfy the requirement for proficiency in writing.) One course. *Staff*

**27S. Studies in Nonliterary Topics.** May be taken twice. One course. *Staff*

**28S. Introduction to Creative Writing.** Consent of instructor required. One course. *Staff*

**29. Composition and Language.** This number represents credit for advanced placement on the basis of the College Board examination in composition and language. One course.

**61S. Writing: Prose Fiction and Drama.** Consent of instructor required. One course. *Staff*

**62S. Writing: Poetry.** Consent of instructor required. One course. *Staff*

**103S, 104S. Writing: Short Stories. (AL)** Class discussion of students' manuscripts; individual conferences with the instructor. Open to sophomores, juniors, and seniors. Consent of instructor required. One course each. *Applewhite, Cox, M. Lentricchia, Pope, Porter, or Price*

**105S, 106S. The Writing of Poetry. (AL)** Meter, image, tone, and dramatic organization in traditional and modern poems as a basis for original composition. Consent of instructor required. One course each. *Applewhite or Pope*

**107S. Playwriting I. (AL)** Fundamentals of writing for stage and screen. Prerequisites: a practical theater course (for example, acting, directing, design, stagecraft) and consent of instructor. C-L: Drama 111S and Film and Video. One course. *Ball*

**108S. Playwriting II. (AL)** Advanced projects in writing for production. Prerequisites: Drama 111S or English 107S, and Drama 101 or 181S, and consent of instructor. C-L: Drama 112S and Film and Video. One course. *Ball*

**109S. Special Topics in Writing. (AL)** Advanced work for majors who have taken at least two previous 100-level writing courses. Prerequisite: consent of instructor. One course. *Staff*

**110S. Writing: Longer Prose Narrative. (AL)** The writing of a novel, novella, or group of short stories. Primarily for juniors and seniors. Consent of instructor required. One course. *Cox, Porter, or Price*

**111. Introduction to Linguistics. (SS)** See C-L: Cultural Anthropology 107; also C-L: Interdisciplinary Course 111 and Linguistics. One course. *Butters, Nygard, or Tetel*

**112. English Historical Linguistics. (SS)** Introduction to methods and principles of historical linguistics, as exemplified by the history of the English language from Proto-Indo-European to the present. C-L: Linguistics. One course. *Butters, Nygard, or Tetel*

**115. Present-Day English. (SS)** Origins, development, and current structure of English, especially in America. Transformational versus traditional and structural grammar, written versus spoken English, social and regional dialects. C-L: Linguistics. One course. *Butters, Nygard, or Tetel*

**117S. Advanced Expository and Persuasive Writing.** See C-L: University Writing Course 117S. One course. *Staff*

**118S. The Teaching of Composition, Grammar, and Literature in Secondary School.** Visits to secondary school English classes, discussion with successful teachers, practice in making presentations, and evaluation of written work and other performance. C-L: Education 189S. One course. *Page (education)*

**119. Current Topics in Linguistics. (SS)** May be repeated as topics vary. See C-L: Cultural Anthropology 112; also C-L: Interdisciplinary Course 119 and Linguistics. One course. *Staff*

#### **For Juniors, Seniors, and Graduates**

**205. Semiotics and Linguistics.** See C-L: Russian 205. One course. *Andrews*

**208. History of the English Language. (SS)** Introductory survey of the changes in sounds, forms, and vocabulary of the English language from its beginning to the present, with emphasis on the evolution of the language as a medium of literary expression. C-L: Linguistics and Medieval and Renaissance Studies. One course. *Butters, Nygard, or Tetel*

**209. Present-Day English. (SS)** A survey of contemporary linguistic theories applied to modern English; designed for students of literature and teachers of English. C-L: Linguistics. One course. *Butters or Nygard*

#### **INTRODUCTION TO LITERATURE**

**20. Literature and Composition.** This number represents credit for advanced placement on the basis of the College Board examination in literature and composition. One course. *Butters and Nygard*

**21S. Studies in the Novel. (AL)** One course. *Staff*

**22S. Studies in Drama. (AL)** One course. *Staff*

**23S. Studies in the Short Story. (AL)** One course. *Staff*

**24S. Studies in Poetry. (AL)** One course. *Staff*

**25S. Studies in the Epic. (AL)** One course. *Staff*

**26S. Studies in Special Topics. (AL)** May be taken twice. One course. *Staff*

**49S. Freshman Seminar.** Topics vary each semester offered. One course. *Staff*

**51, 52. Representative American Writers. (AL)** Selections and complete works. 51: Poe, Emerson or Thoreau, Hawthorne, Melville, Whitman, Dickinson, and Twain; not open to students who have taken English 152 or 153. 52: James, Frost or Robinson, Crane or Dreiser, O'Neill, Faulkner, Hemingway, and others. Not open to students who have taken English 153 or 154. One course each. *Staff*

**91. Introduction to the Study of English Literature. (AL)** Methods of literary analysis through the selected works of Chaucer, Shakespeare, Milton, and Pope. One course. *Staff*

**92. British Literature 1750-1950. (AL)** Studies in the literature of Great Britain from the eighteenth century through the modern period. One course. *Staff*

**93. Introduction to the Study of Literary Genre. (AL)** An introduction, through selected poetry, fiction, and drama, to the distinctive nature of each major genre and to the critical procedures for examining that genre. One course. *Staff*

**93S. Introduction to the Study of Literary Genre. (AL)** A seminar version of English 93. One course. *Wittig*

## ENGLISH AND BRITISH LITERATURE

**121. Medieval English Literature to 1500. (AL)** The principal forms and examples of English prose, poetry, and drama of the Anglo-Saxon and Middle English periods (excluding Chaucer). In translation. C-L: Medieval and Renaissance Studies. One course. *Nygaard or L. Patterson*

**122. Sixteenth-Century English Literature. (AL)** Emphasis in poetry on Wyatt, Sidney, Spenser, Raleigh, and Shakespeare; in prose on Sidney and Sir Thomas More; in drama on Marlowe. C-L: Medieval and Renaissance Studies. One course. *DeNeef, Fish, A. Patterson, Randall, or Schwartz*

**123. English Literature: 1600 to 1660. (AL)** Emphasis in poetry on Jonson and the cavaliers, Donne and the metaphysicals; in drama on Jonson, Tourneur, Webster, and Ford; in prose on character writers, Bacon, Burton, Donne, and Browne. C-L: Medieval and Renaissance Studies. One course. *DeNeef, Fish, A. Patterson, Randall, or Schwartz*

**124. English Literature: 1660 to 1800. (AL)** Major genres and authors such as Dryden, Congreve, Addison, Swift, Pope, Gray, Johnson, Blake, and Defoe or Fielding. One course. *Ferguson or Jackson*

**125. English Literature of the Romantic Period. (AL)** Wordsworth, Coleridge, Byron, Shelley, Keats. One course. *Applewhite, Gleckner, or Jackson*

**126. English Literature: 1832 to 1900. (AL)** Major writers and genres, with special emphasis on Carlyle, Tennyson, Browning, Arnold, the pre-Raphaelites, and Hopkins. Collateral reading from novels. One course. *Ryals or Sedgwick*

**127, 128. Twentieth-Century British Literature. (AL)** Emphasis on principal writers of fiction, drama, and poetry. 127: usually Conrad, Shaw, Yeats, Wells, Synge, Forster, Woolf, and Joyce. 128: usually Lawrence, Cary, Huxley, Auden, Greene, Beckett, and Dylan Thomas. One course each. *Mellown, Moses, Pope, or G. Smith*

**131. Studies in a Single British Author. (AL)** One course. *Staff*

**132. Faith and Fiction in Victorian England. (AL)** (Summer program in England.) Not open to students who have taken English 137. See C-L: Religion 186. One course. *Staff*

**133. Modern British Drama. (AL)** O'Casey, Coward, Eliot, Osborne, Pinter, Beckett, Stoppard, and others. C-L: Drama 121. One course. *Clum or Moses*

**134. Drama and Society. (AL)** Dramas of various ages and cultures in relation to the mores and values of the societies for which they were written. The ways in which contemporary drama and contemporary productions of earlier works reflect the concerns and values of society now. Readings of the texts and background work and viewing of sixteen London theatrical productions. (London summer program). C-L: Drama 149. One course. *Clum*

**135. British Poetry of the Twentieth Century. (AL)** Changes in poetry and its criticism from the Edwardians. Yeats, Housman, Lawrence, Owen, the Sitwells, Graves, Auden, MacNeice, Dylan Thomas, Hughes, and Larkin. One course. *Mellown, Moses, Pope, or G. Smith*

**136. Eighteenth-Century British Novel. (AL)** Defoe, Richardson, Fielding, Smollett, and Sterne; the Gothic novel. One course. *Ferguson or Jackson*

**137. Nineteenth-Century British Novel. (AL)** Scott, Austen, Dickens, Thackeray, Trollope, the Brontës, George Eliot, Meredith, Butler, Hardy, and others. Not open to students who have taken English 132. One course. *Moses, Ryals, or Sedgwick*

**138. Twentieth-Century British Novel. (AL)** Conrad, Lawrence, Forster, Joyce, Woolf, Huxley, Cary, Amis, and Golding. One course. *Mellown, Moses, Pope, or G. Smith*



**139S. Special Topics in British Literature. (AL)** One course. *Staff*

**Major Authors**

**141. Chaucer. (AL)** Focus on *The Canterbury Tales* and its literary and social background. C-L: Medieval and Renaissance Studies. One course. *DeNeef, Nygard, or L. Patterson*

**143, 144. Shakespeare. (AL)** 143: twelve plays before 1600. 144: usually ten plays after 1600. C-L: Drama 115, 116 and Medieval and Renaissance Studies. One course each. *DeNeef, Gopen, Jackson, Jones, A. Patterson, Porter, Randall, or G. Williams*

**145. Milton. (AL)** Poetry and its literary and social background. C-L: Medieval and Renaissance Studies. One course. *Fish, A. Patterson, Price, or Schwartz*

**For Juniors, Seniors, and Graduates**

**207. Old English Language and Literature. (AL)** The pre-Conquest language and representative prose and poetry. One course. *Nygard*

**212. Middle English Literature: 1100 to 1500. (AL)** Selected topics. C-L: Medieval and Renaissance Studies. One course. *Fish, Gopen, Nygard, or L. Patterson*

**221. Renaissance Prose and Poetry: 1500 to 1660. (AL)** Selected topics. C-L: Medieval and Renaissance Studies. One course. *DeNeef, Fish, A. Patterson, Randall, Schwartz, or G. Williams*

**225. Renaissance Drama: 1500 to 1642. (AL)** Selected topics. C-L: Medieval and Renaissance Studies. One course. *A. Patterson, Randall, or G. Williams*

**235. Restoration and Eighteenth-Century Literature: 1660 to 1800. (AL)** Selected topics. One course. *Ferguson or Jackson*

**241. Romantic Literature: 1790 to 1830. (AL)** Selected topics. One course. *Applewhite, Gleckner, or Jackson*

**245. Victorian Literature: 1830 to 1900. (AL)** Selected topics. One course. *Ryals or Sedgwick*

**251. British Literature since 1900. (AL)** Selected topics. One course. *Mellown, Moses, or G. Smith*

**AMERICAN LITERATURE**

**151. American Literature to 1820. (AL)** Colonial authors such as Bradford, Taylor, Cotton Mather, Edwards, Byrd, and Franklin, and authors of the early Republic such as Tyler, Freneau, and C. B. Brown. One course. *Jones, Moon, or Tompkins*

**152. American Literature: 1820 to 1860. (AL)** Prose and poetry of American romanticism: Emerson, Thoreau, Hawthorne, Poe, Melville, and Whitman. Not open to students who have taken English 51. One course. *Anderson, Gerber, Jones, Moon, Tompkins, or K. Williams*

**153. American Literature: 1860 to 1915. (AL)** Dickinson, Twain, James, the social and philosophical essayists, Crane, Dreiser, Robinson, and Frost. Not open to students who have taken English 52. One course. *Anderson, Budd, Gerber, Jones, Moon, or K. Williams*

**154. American Literature: 1915 to 1960. (AL)** Eliot, Fitzgerald, Hemingway, Faulkner, and others. Not open to students who have taken English 52. One course. *Clum, Ferraro, F. Lentricchia, Moon, Moses, Pope, or Strandberg*

**155. Contemporary American Writers. (AL)** Novelists and poets prominent since 1960. One course. *Clum, Ferraro, Moses, or Strandberg*

**161. Studies in a Single American Author. (AL)** One course. *Staff*

**162. Twentieth-Century American Drama. (AL)** Representative plays by O'Neill, Odets, Williams, Miller, Albee, Lanford Wilson, and others. C-L: Drama 120. One course. *Clum*

**163. Twentieth-Century American Poetry. (AL)** The classicism of Pound, Eliot, and the Fugitives in relation to the neoromanticism of Stevens, Williams, Crane, and Roethke. Developments during World War II and after: Lowell, Jarrell, Berryman, Dickey, Lever-  
to, and Wright. One course. *Applewhite, Moon, Moses, or Pope*

**164, 165. American Fiction. (AL)** A survey of the novel and the short story. 164: the nineteenth century; Poe, Hawthorne, Melville, Twain, James, and others. 165: the twentieth century; Hemingway, Faulkner, Fitzgerald, Barth, Pynchon, and others. One course each. *Clum, Ferraro, Moses, Strandberg, or K. Williams*

**167, 168. Afro-American Literature. (AL)** 167: oral and written literary traditions from the American colonial period into the nineteenth century, including the spiritual as lyric poetry and the slave narrative as autobiography. 168: the late nineteenth and the twentieth centuries, Paul Laurence Dunbar to Cyrus Colter. C-L: Afro-American Studies 173, 174. One course each. *K. Williams*

**169S. Special Topics in American Literature. (AL)** One course. *Staff*

#### For Juniors, Seniors, and Graduates

**263. American Literature to 1865. (AL)** Selected topics. One course. *Anderson, Jones, Moon, or Tompkins*

**267. American Literature: 1865 to 1915. (AL)** Selected topics. One course. *Budd, Tompkins, or K. Williams*

**269. American Women Writers. (AL)** Selected topics. C-L: Women's Studies. One course. *Pope or Tompkins*

**275. American Literature since 1915. (AL)** Selected topics. One course. *Ferraro, F. Lentricchia, Moses, Pope, or Strandberg*

#### GENRE, CRITICISM, AND WORLD LITERATURE

**170. Theory of Genre. (AL)** Introduction to literary genre and the critical questions raised about literature when examined from a generic perspective. One course. *DeNeef, Jackson, Moses, or Torgovnick*

**171S. Theater Farce. (AL)** See C-L: Drama 145S. One course. *El Guindi*

**172. Literary Theory.** Major works and theoretical issues in the history of literary criticism. One course. *Staff*

**173. Legend and Literature. (AL)** Classical, Celtic, and/or Germanic legends and their places in later literature. Special attention to monsters in literature and to Arthurian material. One course. *L. Patterson or Torgovnick*

**174. World Theater: Advanced. (AL)** See C-L: Drama 151. One course. *Clum*

**175. Literary Approaches to the Bible. (AL)** Selected books of both Testaments, emphasizing narrative strategies, literary contexts, and Biblical genres: primeval myth, patriarchal history, prophecy, and apocalyptic. One course. *Schwartz*

**176. Introduction to Folklore. (AL)** A survey of the materials of oral tradition (folk-tale, legend, myth, and related forms) and the methods of investigation in the field. One course. *Nygard*

**177. Ballad and Folksong. (AL)** Orally transmitted song traditions, British and American. One course. *Nygaard*

**178. Literature and the Other Arts. (AL)** Selected topics in the study of the interrelation of literature and other art forms, such as music and painting. One course. *Staff*

**179S. Special Topics in a Literary Genre. (AL)** One course. *Staff*

**180. Writings in the Rural Tradition: From the Caribbean to the American South. (AL)** See C-L: Literature 180. One course. *Willis*

**181. Text and Performance. (AL)** The relationship between the written dramatic text and theatrical performance of plays representing different periods, styles, and national origins. The twelve plays chosen from offerings in London, Stratford-on-Avon, and regional festivals. Papers in addition to classroom analysis of texts and productions. (London summer program.) C-L: Drama 148. One course. *Clum*

**184S. Canadian Theater. (AL)** See C-L: Drama 146S; also C-L: Canadian Studies. One course. *Staff*

**186. Canadian Literature in English. (AL)** Eighteenth century to the present. Emphasis on the twentieth century and on novels by Hugh MacLennan, Margaret Laurence, Mordecai Richler, Margaret Atwood, Rudy Wiebe, and others. C-L: Canadian Studies and Comparative Area Studies. One course. *Staff*

#### For Juniors, Seniors, and Graduates

**281. Studies in Genre. (AL)** History, criticism, and theory of literary genres such as the novel, pastoral, epic, and drama. One course. *Staff*

**283S. Feminist Theory and the Humanities.** See C-L: Interdisciplinary Course 283S; also C-L: Religion 269S and Women's Studies. One course. *Clark, Orr, Pope, Sedgwick, or Tompkins*

**285. Major Texts in the History of Literary Criticism. (AL)** A survey of major critical writings from Aristotle to the present. One course. *Staff*

**288. Special Topics. (AL)** Subjects, areas, or themes that cut across historical eras, several national literatures, or genres. One course. *Staff*

**289. The Theory of the Novel. (AL)** Major issues in the history and theory of the novel. One course. *Moses or Torgovnick*

#### CULTURAL STUDIES

**81. Introduction to Film. (AL)** Basic film theory and history of motion picture technology. Introduction to experimental, documentary, and narrative forms of Third World, European, and United States cinemas. Economics and aesthetics. C-L: Drama 65 and Film and Video. One course. *Gaines*

**82. Introduction to Media Studies. (AL)** Film, photography, television, and other popular forms. Interdisciplinary perspectives on television news and serial form, pulp fiction and popular music, documentary film and photography, national cinemas and international advertising, avant-garde performance and theatrical acting, communications policy and legal theory. C-L: Film and Video and Literature 102. One course. *Gaines and staff*

**120. Advertising and Society. (SS)** See C-L: Cultural Anthropology 110; also C-L: Sociology 160 and Women's Studies. One course. *O'Barr (cultural anthropology), J. Smith (sociology), or Wilson (sociology)*



**156. American Popular Culture. (AL)** The formation of American popular culture in different historical periods. Cultural forms including music, movies, fashion, and leisure. C-L: Literature 156. One course. *Radway or Willis*

**157, 158. American Literature and Culture. (AL)** Relationship of literature to the other arts, American intellectual history, religion, science, technology, and architecture. 157: to the Civil War. 158: from the Civil War to 1960. One course each. *K. Williams*

**182. American Film Genres. (AL)** Introduction to study of popular film and television as narrative form and industrial product. Overview of the musical, comedy, western, and gangster genre. Analysis of film stars, history of film technology, and study of audience. C-L: Drama 138 and Film and Video. One course. *Clum, Gaines, or Moses*

**183S. Film and Video Theory and Practice. (AL)** Film and video production in conjunction with comparative history and theory of these technologies. Students produce works in basic Super 8 mm, 16 mm, and small format video production. Prerequisite: Drama 65, English 81, or Literature 177. C-L: Institute of the Arts 115S, Drama 131S, and Film and Video. One course. *Staff*

**185. Studies in Film History. (AL)** Close examination of a particular issue, period, national cinema, or technological development. C-L: Drama 136, Film and Video, and Literature 187. One course. *Clum, Gaines, Jameson, or Moses*

**187. Melodrama and Soap Opera. (AL)** History of melodrama from Victorian theatrical production to television soap opera. Close study of popular women's fiction, silent cinema, the thirties and forties woman's picture, and fifties technicolor melodrama. C-L: Drama 137 and Film and Video. One course. *Clum or Gaines*

**188. Narrative Film and the Novel. (AL)** Continuities in the nineteenth-century realist novel, literary naturalism, and classical narrative cinema. Nonnarrative experimental forms, pulp fiction, and television specialization. C-L: Drama 135, Film and Video, and Women's Studies. One course. *Clum, Gaines, Moses, or Torgovnick*

**189S. Special Topics in Film. (AL)** A major genre, period, or director. Prerequisite: Drama 65 or English 81. C-L: Drama 197S and Film and Video. One course. *Clum, Gaines, or Moses*

**190. Television, Technology, and Culture. (AL)** Television criticism and its relation to film theory. Mainstream television genres, the historical avant-garde, and video art. History of the technology and cross-cultural comparison of television programming. Prerequisite: Drama 65, English 81, or Literature 177. C-L: Drama 139. One course. *Gaines*

## INDEPENDENT STUDY

**191, 192, 193, 194. Independent Study.** Directed reading and research. Students should consult the Director of Undergraduate Studies as early as possible in the preceding term. One course each. *Staff*

**195T. Tutorial.** Directed reading and research. Students should consult the Director of Undergraduate Studies as early as possible in the preceding term. One course. *Staff*

**197S, 198S. Honors Program Sequence.** See *Honors* under THE MAJOR. One course each. *Staff*

## RELATED TOPICS

**71. Essentials of Public Speaking.** See C-L: Drama 81. One course. *Hill or O'Dor*

**72. Essentials of Public Speaking.** Not open to students who have taken English 71 or Drama 81. See C-L: Drama 82. One course. *Hill or O'Dor*

**73S. Argumentation.** Prerequisite: consent of instructor. See C-L: Drama 83S. One course. *O'Dor*

## COURSES CURRENTLY UNSCHEDULED

### 12. Intermediate Composition

#### THE MAJOR

*Basic Requirements.* One course from the following list of introductory courses: English 51, 52, 61S, 62S, 81, 82, 91, 92, 93, 93S. Except by written permission of the Director of Undergraduate Studies, the course must be taken in the first term after the major has been declared (unless it has been taken earlier). It may be taken concurrently with advanced courses.

*Major Requirements.* Eight or more courses at the 100- or 200-level, which are to be organized into a coherent *plan of study* approved by the student's advisor. One of the courses must be a 100-level seminar; one of the courses must be in a major author—Chaucer (English 141), Shakespeare (English 143 or 144), or Milton (English 145).

No later than the second semester of the student's junior year, the student must file a *plan of study* (approved by the student's advisor) with the Director of Undergraduate Studies in English. Typical nine-course *plans of study* include (but are not limited to) four or five courses in such *core* areas as Afro-American literature, American literature, British literature, contemporary writers, creative writing, cultural studies, drama, linguistics, literary theory, the novel, poetry, and women writers. Majors are encouraged to take a broad range of department courses; students thus should select their electives with variety as an important criterion. The plan of study may be altered at any time with the consent of the advisor or the Director of Undergraduate Studies.

*Foreign Languages.* The department recommends that students majoring in English complete at least two years of college-level study, or the equivalent, of a foreign language. Students contemplating graduate work in English should note that many master's programs require examination in one foreign language and that doctoral programs commonly require examination in two. Students interested in linguistics are strongly urged to study at least one non-Indo-European language.

*Teacher Certification.* Each year a number of Duke English majors earn certificates as secondary school teachers. While licensed by the state of North Carolina, such majors are essentially certified for other states as well. Also, such training is urged for those who consider private-school teaching, since most private or parochial schools, other things equal, would prefer the experienced and trained candidate.

Such licensing may be gained as part of the English major and is not as time consuming as sometimes believed. Candidates should select a major plan of study in American literature and choose Shakespeare as their major author, as these emphases correspond to the material of most secondary English programs. Also required are certain other English courses, and two courses in education. The last semester of the senior year is devoted to the Student Teaching Block, including two special, accelerated courses and eight weeks of full-time teaching and observation in the schools, working with a selected teacher and with Duke faculty. This experience leads to an English-teaching certificate to accompany the bachelor's degree.

Anyone considering English teaching should confer with the Program in Education as soon as possible, to help plan out the program.

*Honors.* For English majors in their senior year, the department offers an honors program consisting of a two-semester sequence—English 197S and 198S. These honors seminars raise questions about literary interpretation, introduce students to the principles of sustained research, and provide a forum in which to discuss the writing of the honors thesis. To earn honors, students in the program must present a long thesis—or its equivalent in imaginative writing—by the end of the second semester. The department's Honors Committee will evaluate the theses and award honors according to University guidelines.

Course credit for individual semesters (but not honors) will be given if the work satisfies the course requirement but falls short of the honors standard. Students who want to enter the program must apply to the department's Honors Committee by February 1 of their junior year. Applicants must have a B+ average in English courses; previous grades, recommendations by teachers, a sample of the students' writing, and the students' own statements of purpose in their applications will determine admission.

## Film and Video Program

Assistant Professor Gaines, *Director*

A certificate, but not a major, is available in this program.

The Program in Film and Video is an interdisciplinary course of study which introduces students to the critical analysis of communications technologies: film, photography, and television. Practical production experience is also available through course work and internships. Courses in this area are offered through twelve different academic departments and programs and taught by twenty faculty members. The program also sponsors speakers, film and television screenings, and exhibits in cooperation with the Center for Documentary Photography, the Institute of the Arts, and the Center for International Studies.

Students working toward a certificate in film and video declare a major in an academic department. To qualify for the certificate, students take five courses from the approved list published in this bulletin. One of these courses must be an introductory course selected from those listed below. Program courses are described under the listings of the various departments.

*Note:* The course of study in the Film and Video Program is distinct from that of the Drama Program. The Film and Video Program emphasizes history, theory, and criticism with a production component. The Drama Program emphasizes creative application and production with an academic component. Students may pursue both. See the listings under Drama Program.

### Introductory Courses

English 81. Introduction to Film. C-L: Drama 65. *Gaines*

English 82. Introduction to Media Studies. C-L: Literature 102. *Gaines and staff*

English 182. American Film Genres. C-L: Drama 138. *Clum, Gaines, or Moses*

Cultural Anthropology 110. Advertising and Society. C-L: English 120, Sociology 160, and Women's Studies. *W. O'Barr*

### Cultural Anthropology

118S. The Language of Advertising. C-L: Linguistics. *W. O'Barr*

### Drama

111S, 112S. Playwriting I, II. *Ball*

### English

156. American Popular Culture. C-L: Literature 156. *Radway and Willis*

183S. Film and Video Theory and Practice. C-L: Institute of the Arts 115S and Drama 131S. *Staff*

185. Studies in Film History. C-L: Literature 187 and Drama 136. *Clum, Gaines, or Moses*

187. Melodrama and Soap Opera. C-L: Drama 137. *Clum or Gaines*

188. Narrative Film and the Novel. C-L: Drama 135 and Women's Studies. *Clum, Gaines, Moses, or Torgovnick*

189S. Special Topics in Film. C-L: Drama 197S. *Clum or Gaines*

190. Television, Technology, and Culture. C-L: Drama 139. *Gaines*

### History

127S. History and the Visual Image. *TePaske or Wood*

### Institute of the Arts

110S. Video and Performance. *Desmond*

Dance 181S. Special Topics. *Desmond*

### Literature

177. Film Theory. C-L: Women's Studies. *Gaines*

185. Psychoanalysis, Literature, and Film. C-L: Women's Studies. *Gaines*



### Political Science

- 153, 154. Politics and the Media of Mass Communication. *Paletz*
- 203S. Politics and the Media of Mass Communication. *Paletz*

### Public Policy Studies

- 154S. Journalism and Public Policy. *Stevens*
- 163S. Telecommunications Policy and Regulation. *Geller*
- 176S. American Communities: A Photographic Approach. *Harris*
- 180. Writing for the Media. *Staff*
- 186. Shaping the News. *Barber*
- 240S. Analyzing the News. *Staff*

### Romance Languages

- French 122. The French Film. *Staff*
- French 170. Film and the French Novel. *Jameson*

### Sociology

- 170. Mass Communication. C-L: Canadian Studies and Comparative Area Studies. *Smith*
- 182. The Media in Comparative Perspective. C-L: Interdisciplinary Course 182 and Political Science 180. *Paletz or Smith*

## Forestry and Environmental Studies Courses (FES)

The professional school courses listed below are described fully in the *Bulletin of Duke University: School of Forestry and Environmental Studies*. They are open to undergraduates by consent of the instructor. No major is offered to undergraduates.

Students who are preparing for professional careers in natural resources and the environment should refer to the section on undergraduate-professional combination programs in this bulletin.

- 191, 192. Independent Study. Open to qualified juniors and seniors with consent of the student's major advisor and the instructor. Credit to be arranged. *Staff*
- 200. Student Projects. Prerequisite: consent of the dean of the School of Forestry and Environmental Studies. Credit to be arranged. *Staff*
- 201. Field Studies. Credit to be arranged. *Staff*
- 204. Forest Inventory, Growth, and Yield. One course. *Davison*
- 205. Silviculture. One course. *Oren*
- 207L. Forest Pest Management. One course. *Stambaugh*
- 210L. Forest Pathology. One course. *Stambaugh*
- 211L. Applied Ecology and Ecosystem Management. One course. *Richardson*
- 212. Ecological Toxicology. One course. *Di Giulio*
- 213. Forest Ecosystems. One course. *Richter*
- 215. Environmental Physiology. One course. *Di Giulio and Oren*
- 216. Applied Population Ecology. One course. *Maguire*
- 218. Barrier Island Ecology. Prerequisite: course in general ecology. (Given at Beaufort.) C-L: Biology 218 and Marine Sciences. One and one-half courses. *Staff*
- 221. Soil Resources. One course. *Richter*
- 230. Weather and Climate. One course. *Knoerr*
- 231. Environmental Climatology. One course. *Staff*
- 232. Microclimatology. C-L: Biology 232. One course. *Knoerr*
- 234. Watershed Hydrology. One course. *Staff*
- 236. Water Quality Management. One course. *Reckhow*
- 237. Watershed Modeling and Management. Prerequisite: Forestry and Environmental Studies 234. One course. *Staff*
- 242. Environmental Chemistry. One course. *Faust*
- 261. Remote Sensing for Resource Management. One course. *Davison*
- 267. Wildland and Wildlife Management. One course. *Boyce and Maguire*
- 270. Resource Economics and Policy. Prerequisite: introductory course in economics or consent of instructor. C-L: Public Policy Studies 272. One course. *Kramer*
- 283. Environmental Policy and Values. One course. *Staff*
- 285. Land Use Principles and Policy. One course. *Healy*

### Courses Currently Unscheduled

- 194. Conserving Natural Resources
- 208. Fire Behavior and Use

## French

For courses in French, see Romance Languages.

## The University Program in Genetics

Professor Antonovics, *Director* (botany); Professors Amos (immunology), Bastia (microbiology), Boynton (botany), Counce (cell biology), Gillham (zoology), Gross (biochemistry), Joklik (microbiology), Kredich (medicine and biochemistry), Modrich (biochemistry), Moses (cell biology), Nevins (microbiology), Nicklas (zoology), Ruderman (zoology), C. Ward (zoology), F. Ward (immunology), and Webster (biochemistry); Associate Professors Endow (microbiology), Greene (biochemistry), Greenleaf (biochemistry), Hershfield (medicine and biochemistry), Hsieh (biochemistry), Keene (microbiology), Laurie (zoology), Linney (microbiology), Rausher (zoology), Steege (biochemistry), and Uyenoyama (zoology); Assistant Professors Burdett (microbiology), Holmes (medicine and biochemistry), Johnston (botany), Kaufman (biochemistry), Kohorn (botany), Kreuzer (microbiology), Ostrowski (microbiology and immunology), Pickup (microbiology), Schachat (cell biology), and Swain (microbiology); Adjunct Professors Drake (National Institute of Environmental Health Sciences), Judd (National Institute of Environmental Health Sciences), Kunkel (National Institute of Environmental Health Sciences), Lucchesi (University of North Carolina), Resnick (National Institute of Environmental Health Science), and Sugino (National Institute of Environmental Health Sciences)

A certificate, but not a major, is available in this program.

Acceptance into the certificate program is by arrangement with the Director of the Genetics Program. It is open to majors in all disciplines. The program offers students an opportunity to gain expertise in modern genetics with a view to its application to biology, medicine, public policy, law, or engineering. The courses in the certificate program are taught by members of the University Program in Genetics. Further details may be obtained from the Genetics Program office.

**191, 192. Independent Study.** Directed reading and research under the supervision of faculty instructors from the University Program in Genetics, subject to the consent of the instructor and of the Director of the Genetics Program. Variable credit. *Staff (Genetics Program)*

For descriptions of the courses below consult the listings under the specified departments.

### Required Courses:

- Introductory Biology (Biology 14 or Biology 21, 22)
- Principles of Genetics (Biology 180)
- An advanced course in molecular genetics, for example,
  - Molecular Biology (Biology 205)
  - Molecular Biology II. Nucleic Acids (Biochemistry 268)
  - Molecular Biology of Development (Biology 164)
- Independent study with a member of the Genetics Program (University Program in Genetics 191, 192)

### Additional Courses:

- Any Genetics Program courses listed below.
- Also: Introductory Biochemistry (Biochemistry 227)
- Principles of Cell Biology (Biology 160)
- Advanced Cell Biology (Biology 269)

**Molecular Biology.** (Biology 205.) One course. *Johnston*

**The Molecular Biology of Development.** (Biology 164.) One course. *Ruderman*

**Principles of Genetics.** (Biology 180.) One course. *Antonovics, Boynton, Gillham, and Laurie*

**Genetic Mechanisms.** (Biochemistry 215.) One course. *Webster and staff*

**Molecular Biology II: Nucleic Acids.** (Biochemistry 268.) One course. *Modrich and staff*

**Extrachromosomal Inheritance.** (Biology 283.) One course. *Boynton and Gillham*

**Ecological Genetics.** (Biology 285S.) One course. *Antonovics*

**Evolutionary Mechanisms.** (Biology 286.) One course. *Antonovics, Uyenyoyama, and H. Wilbur*

**Independent Study and Special Problems.** (Biology 191, 192, 224T, 225T, and 226T). Prerequisite: consent of instructor and the appropriate Director of Undergraduate Studies prior to registration.

**Mathematical Population Genetics.** (Biology 288.) Calculus required; statistics and linear algebra recommended. One course. *Uyenyoyama*

## Geology (GEO)

Professor Perkins, *Chairman*; Associate Professor Corliss, *Director of Undergraduate Studies*; Professors Heron, Pilkey, and Rosendahl; Associate Professors Baker, Johnson, and Karson; Assistant Professors Boudreau and Strelitz; Instructor Klein

A major is available in this department.

The department offers introductory and advanced courses in all branches of geology including petrology, geochemistry, geophysics, paleontology, sedimentology and marine geology. The degree requirements emphasize a broad knowledge of both geology and the associated physical sciences. An option is available for one semester of study at the Duke University Marine Laboratory in Beaufort, North Carolina, to fulfill elective requirements for the degree. The B.S. degree in geology provides a strong background for graduate work in earth sciences; the B.S. and A.B. degrees provide background for work in fields allied to geology—environmental law, hydrology, waste disposal, engineering geology, and secondary education.

**10S. Analysis of Outcrops. (NS)** Field interpretation of geologic features. Includes four field trips. Prerequisite: Geology 41 (may be taken concurrently). Half course. *Staff*

**41. Introduction to Geology. (NS)** Earth composition, processes, and structure. One course. *Heron and staff*

**43S. Application of Geologic Principles. (NS)** Mineral and rock classification, topographic and geologic map interpretation. Prerequisite: Geology 41 (may be taken concurrently). Half course. *Staff*

**49S. Freshman Seminar.** Topics vary each semester offered. One course. *Staff*

**53. Introductory Oceanography. (NS)** See C-L: Biology 53. One course. *Pilkey and Searles*

**72. History of the Earth. (NS)** Physical and biological evolution of the earth from the viewpoint of global tectonics. Primarily for science majors. Fee for field trips. Weekend field trip through the Appalachians, and Saturday field trip through the Deep River Triassic Basin. Prerequisite: Geology 41 or consent of instructor. One course. *Corliss*

**99L. Gibraltar to the Sahara: Exploring Geology in Morocco. (NS)** An introduction to practical geology: examining minerals, rocks, fossils, geologic maps and remote sensing. One week of practical work followed by three weeks of fieldwork in the Rif mountains of northern Morocco, the Middle and High Atlas of central Morocco, and the Anti-Atlas range of the Moroccan Sahara. Taught in summer program in Morocco. Prerequisite: consent of instructor. One course. *Baker and Karson*

**105. Fundamentals of Mineralogy. (NS)** Crystal chemistry, crystal physics, mineral identification, and genesis. Lectures or recitations, laboratory, and field trips. Prerequisite: Chemistry 12 (may be taken concurrently). One course. *Klein*

**106. Igneous and Metamorphic Rocks. (NS)** Silicate mineralogy, theory of origin and classification of igneous and metamorphic rocks, and rock identification. Lectures and laboratory. Prerequisite: Geology 105. One course. *Boudreau*



**108. Sedimentary Rocks. (NS)** Authigenic and detrital minerals, theory of origin and classification of sedimentary rocks, and rock identification. Lecture, laboratory, and field trips. Prerequisite: Geology 72 or 105 or consent of instructor. One course. *Heron*

**109S. Marine Sediments. (NS)** Sedimentary processes in nearshore, shelf, and deep-sea environments. Emphasis on field methods and laboratory analyses. (Given at Beaufort.) C-L: Marine Sciences. One course. *Johnson*

**111. Stratigraphic Principles and Applications. (NS)** Prerequisites: Geology 72 and 108 or consent of instructor. One course. *Perkins*

**130. Principles of Structural Geology. (NS)** Description, origin, and interpretation of primary and secondary geologic rock structures. Prerequisites: Geology 106 and 108. One course. *Karson*

**145. Invertebrate Paleontology. (NS)** Biologic and stratigraphic relationships of invertebrates and their phylogeny. Lectures and laboratory. Prerequisite: Geology 72 or consent of instructor. One course. *Corliss*

**191, 192. Independent Study.** Directed reading or research. Open only to qualified juniors and seniors by consent of Director of Undergraduate Studies and supervising instructor. One course each. *Staff*

**195. Independent Study for Nonmajors.** Open to qualified juniors and seniors upon approval of the departmental faculty. One course. *Staff*

**196S. Beach and Island Geological Processes. (NS)** Processes affecting evolution of beaches and barrier islands with emphasis on the effect of constructions. (Given at Beaufort on three weekends.) C-L: Marine Sciences. Half course. *Pilkey*

#### **For Advanced Undergraduates and Graduates**

**200. Beach and Coastal Processes. (NS)** The study of sedimentary processes and geomorphology of nearshore environments with emphasis on both developed and undeveloped barrier island systems. One course. *Pilkey*

**203. Physical Oceanography. (NS)** Physical processes in the oceans: the physical properties of seawater, the dynamics of currents, waves, and tides, and the transmission of light and sound in the sea. (Given at Beaufort.) Prerequisite: Physics 41 or 51. C-L: Marine Sciences. Half course. *Johnson*

**204. Chemical Oceanography. (NS)** An introduction to chemical processes in the oceans: including factors controlling the major ion composition of sea salt, the distribution of dissolved gases in seawater, sediment-seawater interactions, and seawater-basalt interactions at oceanic ridge crests. (Given at Beaufort.) Prerequisites: Chemistry 11 and Geology 203 (may be taken concurrently). C-L: Marine Sciences. One course. *Staff*

**205S. Geological Oceanography. (NS)** The geology of ocean basins, including origin, bottom physiography, sediment distribution, and sedimentary processes. Not open to students who have taken Geology 206S. (Given at Beaufort.) C-L: Marine Sciences. One course. *Johnson*

**206S. Principles of Geological Oceanography. (NS)** Geological aspects of the ocean basins including coastal to deep water sediment types and sedimentation processes, sea floor physiography and environmental problems. One course. *Pilkey*

**208S. Paleooceanography. (NS)** Geology, paleoceanography, and evolution of the oceans, ocean basins, and marine biota based on analysis of deep-sea sedimentary sequences. One course. *Corliss*

**209S. Marine Sediments. (NS)** Same as 109S except additional term paper required. C-L: Marine Sciences. One course. *Johnson*

**212. Carbonate Facies Analysis: Recent and Ancient. (NS)** Origin, distribution, and diagenetic alteration of recent carbonate sediments and their ancient analogs. Prerequisite: Geology 111. One course. *Perkins*

**214S. Sedimentary Petrography. (NS)** Descriptive and interpretive analysis of sediments and sedimentary rocks in thin section, with an emphasis on diagenesis. Prerequisite: consent of instructor. One course. *Perkins*

**215. Clastics Facies Analysis: Recent and Ancient. (NS)** Modern clastic depositional systems and their ancient analogs. Prerequisite: Geology 111. One course. *Heron*

**216. Field Analysis of South Florida Carbonates. (NS)** Analysis of recent sediments and organisms and their Pleistocene analogs. One-week field trip. Pass/fail grading only. Prerequisite: Geology 111 or consent of instructor. Half course. *Perkins*

**217. Field Analysis of Ancient Sedimentary Sequences. (NS)** Regional analysis of ancient clastic and carbonate systems. One-week field trip. Pass/fail grading only. Prerequisite: Geology 111 or consent of instructor. Half course. *Heron and Perkins*

**219. Sediment Transport. (NS)** How river, ocean, and wind currents move solid particles. Dimensional analysis, near-bed turbulence, boundary layer forces, initiation and rates of particle movement, bed-load vs. suspended-load, erosion, deposition, sorting, evolution and motion of dunes and other bed forms. Emphasis on physical understanding of phenomena with application to environmental issues (for example, dust generation, desertification), engineering questions (for example, silting of channels) and geological problems (for example, ripple laminae, size-sorting). Prerequisites: Civil and Environmental Engineering 122 or consent of instructor. One course. *Haff*

**230S. Advanced Topics in Structural Geology and Tectonics. (NS)** Selected topics related to the deformation of rocks, ranging from microstructure to plate tectonics. Prerequisite: Geology 130 or consent of instructor. One course. *Karson*

**233. Oceanic Crust and Ophiolites. (NS)** Structure, tectonics, petrology, and geochemistry of oceanic spreading environments and ophiolite complexes. Prerequisites: Geology 106 and 130 or consent of instructor. One course. *Karson*

**236. Lithosphere Plate Boundaries. (NS)** Plate tectonics and the geological and geophysical expression of orogenic belts, spreading centers, transform faults, subduction zones. Prerequisite: Geology 130 or consent of instructors. One course. *Karson and Rosendahl*

**237S. Structure and Evolution of the Appalachian Orogen. (NS)** Overview of sedimentation, deformation, and metamorphism responsible for the development of the Appalachian Mountain Belt from Newfoundland to Alabama in the context of plate tectonics. Prerequisites: Geology 106, 108, and 130 or consent of instructor. One course. *Karson*

**249. Marine Micropaleontology. (NS)** Introduction to marine microfossils, basic principles of micropaleontology and stable isotope geochemistry with applications to paleoceanography. Lectures and laboratory. One course. *Corliss*

**251. Physics of the Earth. (NS)** Origin, primeval evolution, rotation, potential fields, paleomagnetism, gravity anomalies, earthquake seismology, thermal properties, internal structure of the earth, and thermodynamics of plate motions. Prerequisites: Geology 41, Chemistry 12, Mathematics 32, and Physics 52; or consent of instructor. One course. *Strelitz*

**252. Exploration Seismology. (NS)** Elastic wave theory, reflection and refraction of acoustic waves, field methodologies, computer processing, and interpretation of seismic data. Prerequisites: Geology 41, Mathematics 32, Computer Science 51, and Physics 52; or consent of instructor. One course. *Rosendahl*

**255. Seismic Interpretation. (NS)** Basic rock physics, seismic expression of structural styles, seismic facies analysis, maps generated from seismic data, and basin-wide seismic stratigraphic analysis. Prerequisite: Geology 251; corequisite: Geology 252 or consent of instructor. One course. *Rosendahl and staff*

**260S. Hydrocarbon Exploration. (NS)** Origin, migration, and accumulation of hydrocarbons with emphasis on exploration techniques. Prerequisites: Geology 111 and 251. One course. *Perkins and Rosendahl*

**270. Sedimentary Geochemistry. (NS)** Chemistry of aqueous solutions and authigenic minerals in sedimentary systems. Prerequisites: Chemistry 12 and Mathematics 32. One course. *Baker*

**271. Isotope Geochemistry. (NS)** Theory and applications of stable and radioactive isotope distributions in nature. Prerequisites: Chemistry 12 and Mathematics 32. One course. *Baker*

**272. Biogeochemistry. (NS)** See C-L: Biology 272. Prerequisite: Chemistry 12 or equivalent. One course. *Schlesinger*

**275. Economic Geology. (NS)** Geology and geochemistry of ore deposits. Prerequisite: consent of instructor. One course. *Boudreau*

**281S. Advanced Topics in Igneous Petrology. (NS)** Current topics in igneous petrology including andesite petrogenesis, ocean ridge basalts, and experimental petrology. Prerequisites: Geology 105 and 106. One course. *Staff*

**283S. Experimental Methods in Geology. (NS)** Theory and application of experimental techniques in igneous and metamorphic petrology and high- and low-temperature geochemistry, with examples from recent literature. Prerequisites: Geology 105 and 106 or consent of instructor. One course. *Staff*

**292. Computer Methods in Geology. (NS)** Techniques used in the geological sciences including simulation and forward modeling, inverse and least squares methods, statistical methods and exploratory data analysis as well as graphics. Prerequisites: Mathematics 32 and Computer Science 51, or consent of instructor. One course. *Strelitz*

**295S. Advanced Topics in Geology. (NS)** Topics, instructors, and credits to be arranged each semester. Variable credit. *Staff*

## COURSES CURRENTLY UNSCHEDULED

### 1. Introductory Geology. (NS)

### 253S. Geophysics. (NS)

## THE MAJOR

### For the A.B. Degree

*Prerequisites.* Geology 41 and 72; Chemistry 11 and 12; and Mathematics 31 and 32.  
*Major Requirements.* A minimum of eight geology courses above the introductory levels, including 105, 106, 108, 111, 130, and 145.

### For the B.S. Degree

The Department of Geology offers two programs:

#### Geology: Preparatory to Advanced Studies in Geology

*Prerequisites.* Geology 41 and 72; Chemistry 11 and 12; Mathematics 31 and 32; Physics 41 and 42 or 51 and 52; and Computer Science 51.



*Major Requirements.* Required courses include 105, 106, 108, 111, 130, 145, a field course normally taken during the summer after the junior year, and three other geology courses above the introductory level.

### **Geology: Preparatory to Advanced Studies in Oceanography**

*Prerequisites.* Geology 41 and 72; Geology 53 (or 206); Chemistry 11 and 12; Physics 41 and 42 or 51 and 52; Biology 21L, 22L; Mathematics 31 and 32; and two courses of science electives.

*Major Requirements.* A minimum of seven geology courses above the introductory level, including 105, 106, 108, 111, 130, and 145.

## **Germanic Languages and Literature**

Associate Professor Borchardt, *Chairman*; Assistant Professor Bessent, *Director of Undergraduate Studies and Supervisor of Freshman Instruction*; Professor Rolleston; Associate Professor Alt; Assistant Professors Morton and Rasmussen; Professor Emeritus Phelps; Lecturers Dowell, Johns, and Koepfel; Instructor Bernstein

A major is available in this department.

### **GERMAN (GER)**

**1-2. Elementary German. (FL)** Practice in understanding, speaking, reading, and writing. Classroom techniques are combined with those of the language laboratory and the computer. Two courses. *Bessent and staff*

**14. Intensive German. (FL)** Accelerated introduction to German, combining in one semester the work of German 1-2. Classroom theory and practice with extended exposure to language laboratory and computer programmed instruction. Prerequisite: consent of Director of Undergraduate Studies. Two courses. *Bernstein*

**49S. Freshman Seminar.** Topics vary each semester offered. One course. *Staff*

**63. Intermediate German. (FL)** Prerequisite: German 1-2 or equivalent. One course. *Bernstein and staff*

German 63 is usually followed by 76, 100S, 101, or 117S.

**65-66. German in Review. (FL)** Grammar review, reading of literary and cultural texts, oral practice, and laboratory. Not open to students who have had German 63. Prerequisite: German 1-2, 14, or equivalent. Two courses. *Dowell*

**76. Advanced Intermediate German. (FL)** Specially designed to raise proficiency levels in speaking and reading. Prerequisite: German 63, 66, or equivalent. One course. *Koepfel*

**100S. Business German. (FL)** Introduction to the language of commerce and industry; modes of expression for technology and marketing. Prerequisite: consent of instructor. One course. *Koepfel*

**101. Introduction to German Literature. (AL, FL)** Readings from representative German authors. One course. *Bessent*

**102. German for Legal Studies. (FL)** Legal terminology and concepts; reading of legal documents (codes, cases, contracts, wills); communication about legal and law-related issues. Prerequisites: German 63 or equivalent and consent of instructors. C-L: Law 102. One course. *H. Bernstein and W. Bernstein*

**103S, 104S. Undergraduate Seminars. (AL, FL)** Topics vary. One course each. *Staff*

**105. Composition. (FL)** Syntax with practice in the elements of German expository style, recommended for majors. One course. *Bessent and staff*

**109S. Nineteenth-Century Prose Fiction. (AL, FL)** Emphasis on shorter forms: novelle, fairy tale, legend. One course. *Bessent*

**115S. Drama. (AL, FL)** Development of German drama and stagecraft from *Sturm und Drang* to Brecht's *Epic Theater*. C-L: Drama 124S. One course. *Alt*

**117S, 118S. German Conversation and Composition. (FL)** Primarily conversation with oral and written reports, based on works by contemporary writers of East and West Germany. Required for German majors; other students by consent of instructor. One course each. *W. Bernstein, Bessent, Johns, or Koepfel*

**119S. Advanced Intensive German. (FL)** For advanced students to increase conversational skills. Discussion of current events based on newspaper articles. Emphasis on the finer points of German grammar and style. Equivalent of German 117S or 118S but offered only in the Berlin semester program. One course. *Staff*

**120S. Berlin in Contemporary East and West German Literature. (AL, FL)** Reading and discussion of literary works of East and West German writers with particular focus on Berlin as a divided city and on the German question in general. Offered only in the Berlin semester program. One course. *Staff*

**124S. Reason and Imagination. (AL, FL)** The eighteenth-century revolution in thought and sensibility, and its impact on literature: nature and the organic paradigm, genius, national cultures, and history as evolution and as progress. Lessing, Herder, Klopstock, Wieland, and Lenz. One course. *Morton*

**125S. German Literature to World War I. (AL, FL)** Selected nineteenth- and early twentieth-century texts to explore and define elements of the modern. Kleist, Hoffmann, Büchner, Heine, Nietzsche, and Thomas Mann. One course. *Alt or Rolleston*

**126S. German Literature since World War I. (AL, FL)** From expressionism to the present, the social and intellectual contexts. Mann, Kafka, Rilke, Böll, and Grass. One course. *Rolleston*

**127S. Contemporary Germany. (AL, FL)** The current literary scene in the two Germanies in its cultural, social, and political contexts. C-L: Comparative Area Studies. One course. *Bessent*

**129. Deutsche Kulturgeschichte. (CZ, FL)** An analysis of the larger historical, political, and cultural developments and their influences on present-day Germany. C-L: Comparative Area Studies. One course. *Staff*

**130. German Life and Thought. (CZ)** German cultural and intellectual history. Reading and discussion in English. Taught in English. C-L: Comparative Area Studies. One course. *Borchardt*

**131S. Goethezeit. (AL, FL)** The struggle for order in an age of revolution. Weimarer classicism and the response to the romantic impulse. Herder, Goethe, Schiller, Jean Paul, and Hölderlin. One course. *Morton*

**132. The Romantics. (AL, FL)** Major writers of the romantic movement (1795-1830) considered in their national and international context. One course. *Rolleston*

**137. Aspects of Contemporary German Culture. (CZ, FL)** Offered as part of summer program in Erlangen. One course. *Staff*

**172. Modern German Literature in English Translation. (AL)** Representative works by such writers as Mann, Kafka, Hesse, Brecht, Böll, and Grass. Taught in English. One course. *Borchardt or Morton*

**173. Goethe's *Faust* in English Translation. (AL)** The poem, its place in world literature, and its cultural and historical backgrounds. One course. *Borchardt*

**175. Consciousness and Modern Society. (CZ)** The blend of philosophy, literature, and sociology in German thinking about actual and possible societies. The idea of consciousness as producing involvement, detachment, or transformation. Marx, Nietzsche, Lukacs, Freud, Marcuse, Benjamin, Adorno, and Habermas. Texts and discussion in English. C-L: Comparative Area Studies. One course. *Rolleston*

**181. German for Reading, I. (FL)** Foundations of German grammar and syntax; emphasis on vocabulary and complex verbal structures. Not open for credit to students who have completed German 1-2 or the equivalent. One course. *Staff*

**191, 192. Independent Study.** Directed reading and research. Open only to qualified students in the junior year, by consent of Director of Undergraduate Studies. One course each. *Alt, Bessent, Borchardt, Morton, Rasmussen, or Rolleston*

**193, 194. Independent Study.** Directed reading and research. Open only to qualified students in the senior year, by consent of the department. One course each. *Alt, Bessent, Borchardt, Morton, Rasmussen, or Rolleston*

### For Seniors and Graduates

**200S. Proseminar. (AL, FL)** Fundamental course for advanced study of German. Literary history; schools of criticism; practical exercises in interpretation and research methods. One course. *Alt*

**201S, 202S. Goethe. (AL, FL)** His life and works, in the light of his lasting significance to Germany and world literature. 201S: lyrics, prose, fiction, and selected dramas. 202S: *Faust I and II*. One course each. *Morton*

**205, 206. Middle High German. (AL, FL)** The language and literature of Germany's first classical period. C-L: Linguistics and Medieval and Renaissance Studies. One course each. *Rasmussen*

**207S. German Romanticism. (AL, FL)** The principal writers of the period from 1795 to 1830. One course. *Rolleston*

**209S. Drama. (AL, FL)** Studies in the German-speaking theater with emphasis on the nineteenth century. C-L: Drama 220S. One course. *Alt*

**210S. The Eighteenth Century. (AL, FL)** The culture of reason, progress, and the individual in early modern philosophy and literature. Leibniz, Lessing, Herder, Kant, and Schiller. One course. *Morton*

**211S. Nineteenth-Century Literature. (AL, FL)** From the end of Romanticism through realism. One course. *Alt*

**214S. The Twentieth Century. (AL, FL)** Literature of the twentieth century presented through representative authors. One course. *Rolleston*

**215S. Seventeenth-Century Literature. (AL, FL)** Leading writers of the baroque, viewed against the background of their time. C-L: Medieval and Renaissance Studies. One course. *Borchardt*

**216. History of the German Language. (FL)** Development of the phonology, morphology, and syntax of German from the beginnings to the present. C-L: Linguistics and Medieval and Renaissance Studies. One course. *Rasmussen*

**217S. Renaissance and Reformation Literature. (AL, FL)** The period from 1400 to about 1600. C-L: Medieval and Renaissance Studies. One course. *Borchardt*

**218S. The Teaching of German. (FL)** A survey of modern teaching techniques: problems in the teaching of German on the secondary and college levels. Analysis and evaluation of textbooks, related audiovisual materials, and computer programs. One course. *Alt*



**219. Applied Linguistics. (FL)** The application of modern linguistic principles to a systematic study of the phonetics, morphology, and syntax of modern German. C-L: Linguistics. One course. *Rasmussen*

**230S. Lyric Poetry. (AL, FL)** Studies in poetry and poetic theory. From Goethe and the romantics to Rilke, Benn, and contemporary authors. One course. *Rolleston*

#### Courses Currently Unscheduled

**182. German for Reading, II. (FL)**

#### YIDDISH (YDH)

**181, 182. Elementary Yiddish. (FL)** A thorough study of elementary Yiddish grammar with reading, composition, and oral practice. No previous knowledge of German or Hebrew required. C-L: Judaic Studies. One course each. *Alt*

#### Courses Currently Unscheduled

**171. Yiddish Fiction in Translation. (AL)**

**191, 192. Independent Study**

#### THE MAJOR

Students majoring in German develop language skills in their cultural and literary context. The international and humanistic emphasis makes the German major an appropriate companion to technical and career-oriented concentrations. Numerous opportunities are available, including programs of study abroad, interdisciplinary programs, and Fulbright and German Academic Exchange Service (DAAD) scholarships.

*Prerequisites.* Elementary and intermediate German.

*Major Requirements.* Conversation and composition (German 117S, 118S or equivalent), plus six advanced courses, three of which must be at the 200 level. The following courses may not be used to fulfill major requirements: 172, 173, 181, 182. Either 130 or 175 (but not both) may count towards the major.

*Honors.* Qualified students (see the section on honors in this bulletin) may apply or be invited to apply for graduation with distinction or to achieve Latin honors by project. Latin honors projects must be approved and initiated by the end of the junior year. Further information may be obtained from the Director of Undergraduate Studies.

#### Greek

For courses in Greek, see Classical Studies.

#### Health, Physical Education, and Recreation (PE)

Professor Buehler, *Chairman*; Associate Professor Spangler, *Director of Undergraduate Studies*; Professor Friedrich; Associate Professors Harvey, LeBar, Lloyd, Raynor, Skinner, and Woodyard; Part-time Instructors Beguinet, Bowen, Falcone, Forbes, Gringle, McCauley, McNutt, Orr, Riehl, Sharpe, Sigmon, Strome, Thompson, Trout, and Wilson

Courses in this program do not count toward distributional requirements.

#### ACTIVITY COURSES

The activity courses listed below may be taken by men and women unless otherwise indicated. Each course carries a half-course credit and is given on a pass/fail basis. The maximum amount of credit that counts for the undergraduate degree is one full course, but additional courses may be taken without credit toward graduation.

**10. Adapted Physical Education.** Individualized programs for permanently or temporarily disabled students. Half course. *Staff*

**11. Cardiorespiratory Conditioning and Aerobics.** Individualized programs in walking, jogging, running, cycling, and swimming. Half course. *Buehler*

**12. Dancing for Health.** Dancing for cardiovascular and physical conditioning. Half course. *Sharpe*

**13. Weight Control.** Individualized exercise and diet programs. Prerequisite: consent of physician. Half course. *Staff*

**14. Tension Control.** Techniques for recognizing and reducing tension. Half course. *Friedrich*

**15. Weight Training.** Progressive, cumulative, and measurable physical conditioning. Half course. *Harvey*

**16. Endurance Swimming.** Individualized programs to improve skills and fitness. Half course. *Spangler*

**20. Beginning Swimming.** Propulsion techniques, water safety, introduction to the five basic strokes. Half course. *Spangler*

**21. Intermediate Swimming.** Development of the five basic strokes, overarm side trudgen, and trudgen crawl. Half course. *Spangler*

**22. Advanced Swimming.** Skill development and endurance. Half course. *Spangler*

**24. Lifesaving.** American Red Cross Advanced Lifesaving certification. Half course. *Woodyard*

**25. Water Safety Instructors Course.** American Red Cross Water Safety Instructors certification. Half course. *Woodyard*

**26. Scuba Diving.** Half course. *Thompson*

**27. Kayaking.** Basic skills for kayaking in whitewater. Half course. *Harvey*

**28. Canoeing.** Basic skills for canoeing in whitewater. Half course. *Friedrich*

**29. Water Polo.** Prerequisite: Physical Education 16 or consent of instructor. Half course. *Forbes*

**30. Beginning Golf.** Half course. *Lloyd*

**31. Intermediate Golf.** Stroke development and use of all clubs. Half course. *Lloyd*

**32. Advanced Golf.** Use of all clubs; course strategy. Emphasis on playing. Half course. *Lloyd*

**40. Beginning Tennis.** Half course. *LeBar*

**41. Intermediate Tennis.** Strategy of the game and stroke development. Half course. *LeBar*

**42. Advanced Tennis.** Stroke development with emphasis on strategy. Half course. *LeBar*

**43. Racquetball.** Half course. *Skinner*

**44. Badminton and Racquetball.** Half course. *Friedrich*

**45. Advanced Racquetball.** Development of competitive skills. Half course. *Skinner*

**48. Men's Competitive Tennis.** High level drills, strategy, mental and physical conditioning for those interested in tennis competition. Half course. *LeBar*

49. **Women's Competitive Tennis.** See Physical Education 48. Half course. *LeBar*
50. **Mixed Competitive Tennis.** See Physical Education 48. Half course. *LeBar*
51. **Self-Defense: Karate.** Fundamentals of selected martial arts. Half course. *Bowen*
52. **Fencing.** Foils, épée, and saber. Half course. *Beguinet*
53. **Intermediate Fencing.** Further study of basics and theory. Half course. *Beguinet*
56. **Intermediate Karate.** Continued practice of basic technique. Introduction to round kick, back kick, free sparring, four Pinan Katas of the Wadoryu System. Half course. *Bowen*
60. **Volleyball.** Half course. *Wilson*
65. **Yoga.** Traditional hatha yoga combined with balanced structural alignment to develop strength, flexibility, and mental concentration. Half course. *Orr*
70. **Folk Dancing.** Dances and music, folklore, and costumes. Half course. *Wray*
71. **Square Dancing.** Calls and steps. Half course. *Staff*
72. **Social Dancing.** Waltz, foxtrot, tango, cha-cha, rumba, jitterbug, rock, disco, and others. Half course. *Trout*
80. **Equitation.** Skills in balance seat riding: walk, trot, and canter. Half course. *Sigmon*
81. **Advanced Equitation: Hunt Seat.** Cross-country and stadium jumping techniques. Half course. *Sigmon*
93. **Orienteering.** Route selection and techniques of map reading, compass use, and navigation. Films, lectures, and field practice. Half course. *McNutt*
95. **Wilderness Skills.** Basic and/or intermediate outdoor camping and leadership skills: orienteering, navigation, campcraft, equipment, trip planning, first aid and safety, with emphasis on "learning by doing." Half course. *McNutt*

## THEORY COURSES

100. **Advanced First Aid and Cardiopulmonary Resuscitation.** Certification in advanced first aid and CPR. Half course. *Raynor*
110. **Diet and Nutrition.** Health implications of diet and nutrition: alcohol as food and beverage, anorexia and bulimia, vegetarian options, exercise, "junk" foods, food additives, and other topics. Half course. *Gringle*
112. **Alcohol and Society.** Historical and legal perspectives; alcohol use on college campuses, problem drinking, alcohol dependence, and options for treatment for the alcohol-troubled person. Half course. *Gringle*
115. **Care and Prevention of Athletic Injuries.** Basic instruction in prevention, recognition, care, and rehabilitation of athletic related injuries. Half course. *Riehl*
136. **Health and Fitness.** Theory and practice of personal health: body mechanics, exercise, weight control, and nutrition. Recent research in sports medicine. One course. *Strome*
170. **History of Sports.** Sports from ancient to modern times with an emphasis on sports in America. One course. *Friedrich*
171. **Recreation Leadership.** Concepts and techniques with an emphasis on organizing recreation for special groups. One course. *Friedrich*
174. **Health and Wellness for the College Student.** A problem-solving approach to health concerns. One course. *Friedrich*



# Hindi-Urdu

For courses in Hindi-Urdu, see Asian and African Languages.

## History (HST)

Professor Lerner, *Chairman*; Associate Professor Reddy, *Director of Undergraduate Studies*; Professors Cahow, Cell, Chafe, C. Davis, Durden, Gaspar, Kuniholm, Mauskopf, Miller, Oates, Richards, Roland, A. Scott, W. Scott, TePaske, Witt, and Young; Associate Professors R. Davis, Dirlík, English, Gavins, Goodwyn, Gordon, Herrup, Keyssar, Koonz, S. Nathans, and Wood; Assistant Professors Ewald, Green, Neuschel, Robisheaux, and J. Scott; Professors Emeriti Colton, Ferguson, Franklin, Holley, Parker, Preston, Ropp, and Watson; Lecturers Grimes, Litle, E. Nathans, Roberts, and Wilson

A major is available in this department.

History courses offer students from all disciplines within the University an opportunity to investigate the past, gain perspective on the present, and improve their critical faculties. History provides an integrating principle for the entire learning process, and students of history gain a sense of human development, an understanding of fundamental and lasting social processes, and a feeling for human interrelatedness. History courses train the mind by improving skills in communicating thought and imagination.

### INTRODUCTORY COURSES

Students are urged, but not required, to take two introductory courses before proceeding to advanced-level courses. Majors take a sequence of two introductory courses in history (21, 22; 21S, 22S; 23; 25, 26; 53, 54; 75, 76; 91, 92; 91S, 92S or 93S). Additional courses may be chosen from this group as electives or part of the departmental major.

**21. Europe to the Eighteenth Century. (CZ)** Development and world impact of European civilization, critical evaluation of historical interpretations, and investigation of history from primary sources. One course. *Staff*

**21S. Europe to the Eighteenth Century. (CZ)** A seminar version of History 21. One course. *Staff*

**22. Europe from the Eighteenth Century. (CZ)** Development and world impact of European civilization, critical evaluation of historical interpretations, and investigation of history from primary sources. One course. *Staff*

**22S. Europe from the Eighteenth Century. (CZ)** A seminar version of History 22. One course. *Staff*

**23. Europe to the Eighteenth Century. (CZ, FL)** Readings, lectures, and discussions in *French*; examinations in English. Development and world impact of European civilization, critical evaluation of historical interpretations, and investigation of history from primary sources. Satisfies History 21 requirement for history majors. Taught in French. Prerequisite: French advanced placement credit or French achievement test score of 600 or above; or equivalent. One course. *Witt*

**25. Introduction to World History: To 1700. (CZ)** The beginning and evolution of civilization; major traditions of Eurasia (Greek, Christian European, Indian, Chinese, Islamic); Africans and American Indians; the European invasion of America; foundations of the European world economy; Europe's preparation for world hegemony. C-L: Comparative Area Studies. One course. *Staff*

**26. Introduction to World History: Since 1700. (CZ)** Establishment of European political, economic, and cultural hegemony; non-Western responses; the decline of Western hegemony. C-L: Comparative Area Studies. One course. *Staff*

**49S. Freshman Seminar.** Topics vary each semester offered. One course. *Staff*

**53. Greek History. (CZ)** See C-L: Classical Studies 53. One course. *Rigsby*

**54. Roman History. (CZ)** See C-L: Classical Studies 54. One course. *Boatwright*

**75, 76. The Third World and the West. (CZ)** Economic, social, political, and cultural relationships, 1500 to the present. C-L: Comparative Area Studies. One course each. *R. Davis, Dirlik, Ewald, Gordon, or Richards*

**91. The Development of American Democracy to 1865. (CZ)** The trends vital to an understanding of the United States today. The development of American democracy. Problems of foreign policy, the growth of capitalism, political practices, social reform, and conflicting ideals are considered in relation to this main theme. One course. *Staff*

**91S. The Development of American Democracy to 1865. (CZ)** Seminar version of History 91. One course. *Staff*

**92. The Development of American Democracy, 1865 to the Present. (CZ)** A continuation of History 91 with emphasis upon the emergence of contemporary problems in the United States. Students who have taken History 93S may not receive credit for History 92. One course. *Staff*

**92S. The Development of American Democracy, 1865 to the Present. (CZ)** Seminar version of History 92. One course. *Staff*

**93S. Modern American History. (CZ)** Same as History 92, but emphasizing additional topics considered appropriate for the Twentieth-Century America Program. Open only to students in that program. One course. *Staff*

## UNDERGRADUATE COLLOQUIA

Colloquia are open without prerequisite to all undergraduates and are designed for the nonspecialist, although history majors may take them for credit. Each colloquium consists of reading and discussion involving an explicit historical theme. Short papers, reports, and a final examination may be required. Unlike seminars, which emphasize materials and methods of historical research, colloquia concentrate on historical literature.

**101C. Terrorism, 1848-1968. (CZ)** A comparative analysis of the origins and development of modern terrorism in the West (Europe, Russia, and the United States). C-L: Comparative Area Studies. One course. *M. Miller*

**101G, 102G. Introduction to Islamic Civilization. (CZ)** See C-L: Interdisciplinary Course 162, 163; also C-L: Comparative Area Studies; Cultural Anthropology 147, 148; and Religion 162, 163. One course each. *Lawrence and staff*

**101H. Structures, Science, and Society. (CZ)** The historical and scientific importance of selected structures. Monuments, buildings, bridges, and machines from Stonehenge to nuclear reactors. (Taught in summer program in London.) One course. *Mauskopf*

**101K. Topics in Chinese Civilization. (CZ)** One course. *Dirlik*

**101L. History of Modern Spain. (CZ)** (Taught in fall program in Spain.) One course. *Staff*

## UNDERGRADUATE SURVEY COURSES

**100. Science and Technology in the Ancient World. (CZ)** See C-L: Classical Studies 101. One course. *Rigsby*

**103. History of Greek and Roman Civil Law. (CZ)** See C-L: Classical Studies 102. One course. *Oates*

**104. The Intellectual Life of Europe, 1250-1600. (CZ)** C-L: Comparative Area Studies and Medieval and Renaissance Studies. One course. *Robisheaux or Witt*

**105. Brazilian History in Comparative Perspective. (CZ)** A survey of Brazilian history from colonial times to the present with emphasis on the nineteenth and twentieth centuries. Social, cultural, economic, and political issues in comparative Latin American perspective. (Taught in summer program in Brazil.) One course. *Staff*

**106. Working Class History in the United States. (CZ)** A social history of the working class, as well as a political history of labor, from the early nineteenth century to the present. One course. *Keyssar*

**107, 108. Social and Cultural History of England. (CZ)** English history from the fourteenth century to the present time in an effort to arrive at a synthesis of ideas, social conditions, and political events and thus provide a background for the study of English literature. 107 cross-listed with Medieval and Renaissance Studies. C-L: Comparative Area Studies. One course each. *Cell or Herrup*

**109. Contemporary International Problems: Their Historical Origins and Their Implications for Future Policy. (SS)** C-L: Comparative Area Studies 109, Cultural Anthropology 109, Political Science 160, and Sociology 175. One course. *Staff*

**111. Early America to 1760. (CZ)** Pre-Columbian explorations, European invasion of North America, the evolution of race slavery, and the responses of the native American peoples. One course. *Wood*

**112. Era of the American Revolution, 1760-1815. (CZ)** Origins, evolution, and consequences. Attention to economic, social, and geographical questions, as well as military and political. One course. *Wood*

**113. The United States from the 1890s to 1940. (SS)** Economic, social, and political history of the United States from the Populist revolt to the end of the New Deal. One course. *Keyssar*

**115. History of Africa. (CZ)** Social, political, and economic development in sub-Saharan Africa from 1400 to the present. C-L: Comparative Area Studies and Women's Studies. One course. *Ewald*

**116. Introduction to Medieval Studies. (CZ)** See C-L: Interdisciplinary Course 114; also C-L: Medieval and Renaissance Studies. One course. *Solterer, Witt, and staff*

**117. Early Modern Europe. (CZ)** The economic, social, and political history of early modern Europe. C-L: Comparative Area Studies and Medieval and Renaissance Studies. One course. *Neuschel*

**119. Modern European Intellectual and Cultural History. (CZ)** The period between the French Enlightenment and the First World War: nationalism, ideology, revolution, and social theory; the writings of Hegel, Marx, Nietzsche, and Freud. C-L: Comparative Area Studies. One course. *M. Miller*

**120. History of Socialism and Communism. (CZ)** The origins and development of socialist and communist movements from pre-Marxian times to the present. C-L: Comparative Area Studies. One course. *Lerner*

**121A. America in International Affairs, 1689-1861. (CZ)** The diplomacy of the Colonial, Revolutionary, and early national periods. One course. *C. Davis*

**121B. The United States as a World Power: 1861-1941. (CZ)** American diplomacy from the beginning of the Civil War to entry into World War II. One course. *C. Davis*

**122. American Diplomacy and Issues of War and Peace since Entry into World War II. (CZ)** One course. *C. Davis*



**123S. Madness and Society in Historical Perspective. (SS)** Mental illness and psychiatric treatment from antiquity to the present with special concentration on the nineteenth and twentieth centuries in Europe, America, and Russia. One course. *M. Miller*

**124S. Slave Society in Colonial Anglo-America: The West Indies, South Carolina, and Virginia. (CZ)** The development of slave-based societies and the production of staple crops for export. One course. *Gaspar*

**125. Religion in Greece and Rome. (CZ)** See C-L: Classical Studies 103. One course. *Boatwright or Rigsby*

**126. Women in the Ancient World. (CZ)** See C-L: Classical Studies 104; also C-L: Women's Studies. One course. *Boatwright*

**129. Experiment in Republicanism: The United States, 1787-1860. (CZ)** One course. *S. Nathans*

**130. From Victorian to Corporate America, 1820-1900. (CZ)** One course. *S. Nathans*

**131. History of Mexico and the Spanish Caribbean in the Nineteenth and Twentieth Centuries. (CZ)** Political, economic, and social developments in Mexico and the Spanish Caribbean with emphasis upon comparison of the Cuban and Mexican Revolutions. C-L: Comparative Area Studies. One course. *TePaske*

**133. Medieval Europe, 300-1400. (CZ)** C-L: Medieval and Renaissance Studies. One course. *Young*

**134. Medieval England. (CZ)** From the fifth through the fourteenth centuries. C-L: Medieval and Renaissance Studies. One course. *Young*

**135. Germany from the Thirty Years' War to Unification in 1871. (CZ)** Emphasis on changes in German society. One course. *Koonz*

**136. Germany since Unification in 1871. (CZ)** Emphasis on social history. One course. *Koonz*

**137. Strategies of Comparative Analysis. (SS)** See C-L: Comparative Area Studies 125; also C-L: Cultural Anthropology 125, Political Science 125, and Sociology 125. One course. *Staff*

**138. Renaissance and Reformation Germany. (CZ)** The interplay of social, economic, and political developments in Central Europe from the eve of the Reformation to the end of the Thirty Years' War, with particular attention to the links between religion, gender, and the social order. C-L: Comparative Area Studies and Medieval and Renaissance Studies. One course. *Robisheaux*

**139. China since 1949: The People's Republic. (CZ)** The Chinese path to communism and the communist transformation of Chinese society. C-L: Comparative Area Studies. One course. *Dirlik*

**140. Medieval and Early Modern India, Pakistan, and Bangladesh. (CZ)** Surveys the Islamic period of South Asian history from c. 1200 A.D. to 1750 A.D. Special emphasis on the Delhi Sultanate, the Kingdom of Vijayanagara, the Rajput Confederacy, the Mughal Empire, and the Maratha before British conquest. C-L: Comparative Area Studies. One course. *Richards*

**141. Imperial China. (CZ)** A survey course from antiquity to the modern period (eighteenth century). An exploration of social, economic, intellectual, and political themes. C-L: Comparative Area Studies. One course. *R. Davis*

**142. China: Roots of Revolution. (CZ)** A survey of modern Chinese history with special emphasis on the nineteenth and twentieth centuries. C-L: Comparative Area Studies. One course. *Dirlik*

- 143. Ancient and Early Modern Japan. (CZ)** Japan from earliest settlement to 1868; the Heian Court, rise of the samurai, feudal society and culture, the Tokugawa age, and the Meiji Restoration. C-L: Comparative Area Studies. One course. *Gordon*
- 144. The Emergence of Modern Japan. (CZ)** Japan from Meiji to microchips. The Meiji settlement, industrialization and urban growth; political parties, social movements, and foreign policy in the imperial era; World War II and the American occupation; economic recovery. C-L: Comparative Area Studies. One course. *Gordon*
- 145, 146. Afro-American History. (CZ)** The black experience in America from slavery to the present. C-L: Afro-American Studies 145, 146. One course each. *Gavins*
- 148. Introduction to Renaissance Studies. (CZ)** See C-L: Interdisciplinary Course 115; also C-L: Medieval and Renaissance Studies. One course. *Robisheaux, Schwartz, and staff*
- 149. Military History. (CZ)** War, politics, and technology. One course. *Roland*
- 150. Canadian and American Agrarian Movements. (SS)** A comparative study of the impact of industrialization on the agricultural societies of Canada and the United States, 1880-1935. C-L: Canadian Studies. One course. *Goodwyn*
- 152. The Modern Middle East. (CZ)** The historical development of the Middle East in the nineteenth and twentieth centuries. The emergence of nation-states in the region following World War I. One course. *Y. Miller*
- 153S. The Insurgent South. (CZ)** C-L: Interdisciplinary Course 153S. One course. *Goodwyn*
- 154. The Rise and Fall of European Liberalism, 1688-1945. (CZ)** Development and decline of European liberalism and its impact on European societies and political institutions. One course. *Reddy*
- 155. Imperialism to 1914. (CZ)** European reconnaissance and expansion; mercantilism; slave trade and slave societies; empire in India and Southeast Asia; American colonial revolutions; the "New Imperialism"; Asian and African collaboration and resistance. One course. *Cell*
- 156. Imperialism since 1914. (CZ)** Nationalism in Asia and Africa; decolonization; underdevelopment, neocolonialism, and problems of post-colonial societies. One course. *Cell*
- 157, 158. The Rise of Modern Science. (CZ)** The development of science and medicine, with attention to cultural and social influences upon science. 157: through Newton. 158: eighteenth to twentieth centuries. One course each. *Mauskopf*
- 159S. The Palestine Problem and United States Public Policy. (CZ)** See C-L: Public Policy Studies 175S; also C-L: Comparative Area Studies. One course. *Kuniholm*
- 160. The United States from the New Deal to the Present. (CZ)** C-L: Women's Studies. One course. *Chafe*
- 161, 162. History of Modern Russia. (CZ)** 161: origins of Kievan Russia in the ninth century through the reign of Catherine the Great (1762-1796), concentrating on the formation of the imperial state, class elites, and psychological interpretations of the rulers. 162: nineteenth and early twentieth centuries to the death of Lenin, stressing the opposition movements in society. C-L: Comparative Area Studies. One course each. *M. Miller*
- 163. Foundations of Chinese Civilization. (CZ)** (Taught in China.) See C-L: Cultural Anthropology 163; also C-L: Comparative Area Studies. One course. *Staff*
- 164. India, Pakistan, and Bangladesh: 1750 to the Present. (CZ)** Social and economic impact of Western rule, development of nationalism and independence. C-L: Comparative Area Studies. One course. *Richards*

**167S. United States and Canadian Constitutional Issues. (CZ)** A comparative study of the development of federalism. C-L: Canadian Studies and Comparative Area Studies. One course. *Cahow*

**168S. The Atlantic Slave Trade. (CZ)** The development of the slave trade from the fifteenth century to its abolition in the nineteenth century; organization and mechanics, impact on Europe, Africa, and the Americas. C-L: Comparative Area Studies. One course. *Gaspar*

**169, 170. The Social History of American Women. (CZ)** C-L: Women's Studies. One course each. *A. Scott*

**171. A History of Women in Europe. (CZ)** Women in Europe since medieval times, with particular attention to economic, social, and intellectual experience. C-L: Comparative Area Studies and Women's Studies. One course. *Neuschel*

**173. History of Spain from Late Medieval Times to the Present. (CZ)** Development of the Spanish nation-state from the times of Ferdinand and Isabella, Charles V, and Philip II to the Franco regime and its aftermath. C-L: Comparative Area Studies and Medieval and Renaissance Studies. One course. *TePaske*

**174. History of Colonial Hispanic America from Pre-Columbian Times to the Wars of Independence. (CZ)** The pre-Columbian cultures, European conquest and its effects on the Amerindian peoples, and development of the Spanish and Portuguese Empires to the wars of independence, with special emphasis upon colonial institutions and socioeconomic developments. C-L: Comparative Area Studies and Medieval and Renaissance Studies. One course. *TePaske*

**175S. The Southern Plantation as Historical Laboratory: Odyssey in Black and White, 1770-1970. (CZ)** Readings and discussion on the plantation as a microcosm of Southern social history since 1770, emphasizing the parallel evolution of black and white communities, families, economies, cultures, perceptions, and power struggles. One course. *S. Nathans*

**176S. The Southern Plantation as Historical Laboratory: Research Seminar. (CZ)** Original research projects and seminar discussions on the social history of the plantation and its black and white inhabitants, relying on manuscripts at Duke and at the Southern Historical Collection, statistical records, the architectural legacy, literary and oral testimony, material culture, and folklore. One course. *S. Nathans*

**177. Modern Latin America. (CZ)** A survey of nineteenth- and twentieth-century economic, social, and cultural change. C-L: Comparative Area Studies. One course. *Staff*

**179. History of South Africa, 1600-1960. (CZ)** The relationships among South Africa's racial and cultural communities, with special attention to economic and political developments within each community and the impact of those developments on their mutual interactions. C-L: Comparative Area Studies. One course. *Ewald*

**180. The Soviet Experience. (CZ)** A survey of the history of Russia and the Soviet Union from the eve of the Revolution to the present day with particular emphasis on political, social, and cultural change and continuity. Not open to students who have had History 262. C-L: Comparative Area Studies. One course. *Lerner*

**181. Alexander the Great. (CZ)** See C-L: Classical Studies 135. One course. *Oates*

**182. Politics and Culture in Renaissance Florence. (CZ)** (Taught in summer program in Italy.) C-L: Comparative Area Studies. One course. *Witt*

**183S. Canada from the French Settlement. (CZ)** Problems in the development of Canada and its provinces. C-L: Canadian Studies and Comparative Area Studies. One course. *Cahow*



**184. An Introduction to Canada and Canadian Issues. (SS)** See C-L: Interdisciplinary Course 184; also C-L: Canadian Studies, Comparative Area Studies, Economics 184, Political Science 184, and Sociology 184. One course. *Cahow*

**185. American Diplomacy from the Kennedy Administration to the Present. (SS)** C-L: Public Policy Studies 185. One course. *C. Davis or Kuniholm*

**186. Marxism and Society. (SS)** See C-L: Cultural Anthropology 139; also C-L: Education 139, Interdisciplinary Course 139, and Sociology 139. One course. *Fox or Wilson*

**187. History and Religions of North Africa. (CZ)** See C-L: Religion 164; also C-L: Comparative Area Studies and Interdisciplinary Course 164. One course. *Lawrence*

**188. German History from 1870 to 1970. (CZ, FL)** Analysis of the major historical, social, economic, and cultural developments of German history, from the founding of the German Reich through the post World War II period. Taught in German for Duke students by a faculty member of the Free University of Berlin. C-L: Comparative Area Studies. One course. *Staff*

**190. Twentieth-Century Japanese History.** A survey of major trends and themes in Japanese history in the twentieth century. One course. *Gordon*

**199. The History of Women in Science and Medicine. (CZ)** The history of scientific and medical theories about women and an analysis of women as participants in the evolution of science and medicine. One course. *Green*

## SMALL GROUP LEARNING EXPERIENCES

### Independent Study

Independent study is usually undertaken by students concurrently with a course or with an instructor with whom they have had a course. Students should submit to the instructor in writing a detailed description of intent in the study. Both the instructor's consent and approval of the Director of Undergraduate Studies are required for enrollment.

**191, 192. Independent Study.** One course each. *Staff*

### Undergraduate Seminars

See also History 21S, 22S, 49S, 91S, 92S, 93S, 123S, 124S, 127S, 153S, 159S, 167S, 168S, 170S, 175S, 176S, 183S.

**165S, 166S. Seminars in Selected Topics.** Course content determined by instructor. Prerequisite: consent of instructor. One course each. *Staff*

**195S, 196S. Seminars for Undergraduates.** Opportunities for historical investigation of significant problems. Juniors as well as seniors may apply for admission to these courses and are urged to do so if they expect to be candidates for graduation with distinction in history or if they expect to practice-teach in their senior year. Open to majors and non-majors. The sections are listed below. Most sections are offered for year-long study and carry two course credits. Sections 25 through 32 and sections 35 through 37 are offered only for one semester and carry one course credit. One course each. *Staff*

1. Renaissance Intellectual History, 1300 to 1600. C-L: Medieval and Renaissance Studies. *Witt*
2. Twentieth-Century Europe. *Colton*
3. Problems in the Social and Intellectual History of the United States. *Holley*
4. Medicine and Society in America. *English*
5. The Age of the American Revolution. *Wood*
6. The Era of the American Civil War, 1820-1900. *Durden*
7. Socialism and Revolution in East Asia. C-L: Comparative Area Studies. *Dirlik*
11. Problems in Modern British History. *Cell*
12. Europe and the World since 1914. *W. Scott*

13. Problems in Early Modern English History. C-L: Medieval and Renaissance Studies. *Herrup*
15. The Emergence of Industrial Society in Western Europe, 1780-1914. *Reddy*
16. Science and Society. *Mauskopf*
17. Problems in the History of Modern Japan. C-L: Comparative Area Studies. *Gordon*
18. Problems in the History of Russia before 1917. C-L: Comparative Area Studies. *Lerner or Miller*
19. Social Conflict and Political Change in the United States, 1789-1860. *S. Nathans*
20. Comparative Problems in Early Modern European History. C-L: Medieval and Renaissance Studies. *Neuschel or Robisheaux*
21. Problems in Indian History. C-L: Comparative Area Studies. *Richards*
22. Problems in Latin American History. C-L: Comparative Area Studies. *TePaske*
23. Issues in the History of Tropical Africa. C-L: Comparative Area Studies. *Ewald*
24. Problems in Recent United States Diplomatic History. *C. Davis*
25. Problems in Twentieth-Century American History. *Chafe*
26. Popular Protest in British Society, 1750-1914. *Staff*
27. Origins of the Cold War. *Kuniholm*
28. The Black Death and the Crisis of Late Medieval Europe. C-L: Medieval and Renaissance Studies. *Robisheaux*
29. Problems in the History of Women in Europe. *Neuschel*
30. Traditions in China and the West. C-L: Comparative Area Studies. *R. Davis*
31. Issues in Third World Women's History. *Ewald*
32. Crime and Society: Changing Definitions of Criminality in England and America. *Herrup*
33. Political Participation in the United States. *Keysar*
34. Comparative Race Relations: South Africa and America. *Cell*
35. Palestine and the Arab-Israeli Conflict. *Y. Miller*
37. Women in Science and Medicine. *Green*

**1975-1985. Senior Honors Seminar.** Designed to introduce qualified students to advanced methods of historical research and writing and to the appraisal of critical historical issues. Open only to seniors, but not restricted to candidates for graduation with distinction. This course, when taken by a history major, is accompanied by either a year-long 1955-1965 seminar or two courses at the 200 level. In unusual circumstances, with consent of the instructor, coordinator of the senior honors seminar, and Director of Undergraduate Studies, 191-192 may replace the two courses of 1955-1965 seminars or the two courses at the 200 level. Two courses. *Staff*

#### ADVANCED COURSES (FOR SENIORS AND GRADUATES)

Students may receive credit for either semester of a hyphenated course at the 200 level without taking the other semester if they obtain written consent from the instructor.

**201S. The Russian Intelligentsia and the Origins of the Revolution. (CZ)** Origin and dynamics of the Russian revolutionary movement, the intelligentsia, and the emergence of the labor movement. C-L: Comparative Area Studies. One course. *M. Miller*

**202S. The Russian Revolution. (CZ)** An analysis of the Bolshevik seizure of power in 1917 and the establishment of a revolutionary society and state during the 1920s. C-L: Comparative Area Studies. One course. *M. Miller*

**207, 208. Constitutional History of Britain: The Rise of the Common Law. (CZ)** The origins and development of Britain's law and constitution, related to its setting in a changing society. 207 cross-listed with Medieval and Renaissance Studies. C-L: Comparative Area Studies. One course each. *Herrup*

**215-216. The Diplomatic History of the United States. (CZ)** Not open to undergraduates who have had History 121, 122. C-L: Canadian Studies. Two courses. *C. Davis*

**217S, 218S. Western Europe in the Twentieth Century. (CZ)** Selected topics in political and social history: Europe in 1900; the impact of two world wars; the social politics of the Great Depression; Fascism and Nazism; economic recovery and changes after 1945. C-L: Comparative Area Studies. One course each. *Colton*

**219S, 220S. History of Science and Technology. (CZ)** The interaction of science and technology in the Western world from earliest times to the present. One course each. *Mauskopf and Roland*

**221. Topics in the Social and Economic History of Europe, 1200-1700. (CZ)** C-L: Comparative Area Studies and Medieval and Renaissance Studies. One course. *Staff*

**222. Problems in the Intellectual History of the European Renaissance and Reformation. (CZ)** Prerequisites: History 104 and reading knowledge of German, French, or Italian. C-L: Medieval and Renaissance Studies. One course. *Witt*

**225S. Problems in Comparative Labor History. (SS)** Common dilemmas and varying solutions in the cross-national development of labor-management relations, their political implications, and their larger historical significance. One course. *Gordon, Keyssar, or Reddy*

**226. Topics in the Labor History of the United States. (SS)** One course. *Keyssar*

**227-228. Recent United States History: Major Political and Social Movements. (CZ)** C-L: Women's Studies. Two courses. *Chafe*

**231S, 232S. Problems in the History of Spain and the Spanish Empire. (CZ)** C-L: Comparative Area Studies. One course each. *TePaske*

**233S. Slave Resistance and Social Control in New World Societies. (CZ)** The operation of slave societies in the Americas from the sixteenth to the nineteenth centuries focusing on master-slave relations and slave resistance. C-L: Comparative Area Studies. One course. *Gaspar*

**235S. The Antebellum South. (CZ)** The economic, political, and social aspects of life in the South, 1820-1860. One course. *S. Nathans*

**237S. Europe in the Early Middle Ages. (CZ)** C-L: Medieval and Renaissance Studies. One course. *Young*

**238S. Europe in the High Middle Ages. (CZ)** C-L: Medieval and Renaissance Studies. One course. *Young*

**239S. History of Socialism and Communism. (CZ)** Problems in the origins and development of socialist and communist movements. C-L: Comparative Area Studies. One course. *Lerner*

**241-242. United States Constitutional History. (CZ)** 241: to 1865; 242: 1865 to present. Two courses. *Cahow*

**243-244. Marxism and History. (SS)** Critical examination of Marxist theory and its relevance to historical understanding and explanation. Two courses. *Dirlik*

**245, 246. Social and Intellectual History of China. (CZ)** C-L: Comparative Area Studies. One course each. *R. Davis and Dirlik*

**247. History of Modern India and Pakistan, 1707-1857. (CZ)** C-L: Comparative Area Studies. One course. *Richards*

**248. History of Modern India and Pakistan, 1857 to the Present. (CZ)** C-L: Comparative Area Studies. One course. *Richards*

**249-250. Social and Intellectual History of the United States. (CZ)** The interplay of ideas and social practice through the examination of attitudes and institutions in such fields as science and technology, law, learning, and religion. Two courses. *Holley*

**253S, 254S. European Diplomatic History, 1871-1945. (CZ)** Origins of the First and Second World Wars, the diplomacy of the wars, and the peace settlements which followed them. C-L: Comparative Area Studies. One course each. *W. Scott*

**260. Fifth and Fourth Century Greece. (CZ)** See C-L: Classical Studies 222. One course. *Oates or Rigsby*



**261. Alexander and the Hellenistic World. (CZ)** See C-L: Classical Studies 223. One course. *Oates*

**262. Problems in Soviet History. (CZ)** Studies in the background of the Revolution of 1917 and the history and politics of the Soviet state. C-L: Comparative Area Studies. One course. *Lerner*

**263. The Roman Republic. (CZ)** See C-L: Classical Studies 224. One course. *Boatwright or Rigsby*

**264. The Roman Empire. (CZ)** See C-L: Classical Studies 225. One course. *Boatwright*

**265S. Problems in Modern Latin American History. (SS)** C-L: Comparative Area Studies. One course. *Staff*

**267S. England in the Sixteenth Century. (CZ)** C-L: Medieval and Renaissance Studies. One course. *Herrup*

**268S. England in the Seventeenth Century. (CZ)** C-L: Medieval and Renaissance Studies. One course. *Herrup*

**269S-270S. British History, Seventeenth Century to the Present. (CZ)** Historiography of social structure and social change: English Revolution, party, the Industrial Revolution, class and class consciousness, Victorianism, and the impact of war in the twentieth century. C-L: Comparative Area Studies. Two courses. *Cell*

**273S, 274S. Topics in the History of Science. (CZ)** Critical stages in the evolution of scientific thought. One course each. *Mauskopf*

**277S. The Coming of the Civil War in the United States, 1820-1861. (CZ)** One course. *Durden*

**278S. The Civil War in the United States and Its Aftermath, 1861-1900. (CZ)** One course. *Durden*

**279, 280. Health, Healing, and History. (CZ)** The development of medicine within the broader cultural context from prehistory to the twentieth century. One course each. *English*

**282S. Canada. (SS)** A research seminar for advanced students familiar with Canada. Topics vary each semester; recent perspectives have included nationalism, Canadian-American relations, regionalism in the Maritimes and the West, and cross-border environmental issues, among others. C-L: Canadian Studies, Comparative Area Studies, Cultural Anthropology 282S, Interdisciplinary Course 282S, Political Science 282S, and Sociology 282S. One course. *Cahow*

**284S. Feminist Theory and the Social Sciences. (SS)** History majors should consult with the department about whether this course meets senior seminar requirements for the major. See C-L: Interdisciplinary Course 284S; also C-L: Cultural Anthropology 284S, Political Science 264S, Psychology 284S, Sociology 284S, and Women's Studies. One course. *Chafe, Neuschel, O'Rand, C. Smith, or Spenner*

**285S, 286S. Oral History. (SS)** Research on race relations and civil rights in the United States in the twentieth century using techniques of oral history. Prerequisite: consent of instructor. One course each. *Chafe and Goodwyn*

### Upperclassmen-Graduate Seminars

See History 201S, 202S, 217S, 218S, 219S, 220S, 229S, 230S, 231S, 232S, 233S, 234S, 237S, 238S, 239S, 253S, 254S, 265S, 267S, 268S, 269S-270S, 273S, 274S, 277S, 278S, 282S, 284S, 285S, 286S.

## COURSES CURRENTLY UNSCHEDULED

- 118. Science in the Twentieth Century. (CZ)
- 127S. History and the Visual Image. (SS)
- 132. Major South American Nations, 1850 to the Present. (CZ)
- 147. History of Weapons. (SS)
- 151. History of Technology. (CZ)
- 172A. Contemporary Science: Issues and Challenges. (CZ)
- 172B. Contemporary Technology: Issues and Challenges. (SS)
- 178. American Diplomacy during World War II and the Early Cold War: 1939-1961. (SS)
- 189. The Americas: A Survey of the Forces Shaping the Hemisphere. (SS)
- 193, 194. Introduction to the Civilizations of Southern Asia. (CZ)
- 212. The American Indian in the Revolutionary Era, 1760-1800. (CZ)
- 229S, 230S. Revolution in Modern Europe, 1789-1919. (CZ)
- 234S. Political Economy of Development: Theories of Change in the Third World. (SS)
- 259. Archaic Greece. (CZ)
- 266. Late Antiquity. (CZ)

## HISTORY COURSES BY FIELDS

History courses for undergraduates are offered in five fields, as noted below; students majoring in the department must complete at least one course in each of three fields. A course listed in two fields may be used to meet the requirement in either of those fields, but may not be used for both.

**Africa, Asia, Canada, Caribbean, Latin America, Russia.** History 25, 26, 75, 76, 101G, 102G, 101K, 105, 109, 110, 115, 120, 124S, 128, 131, 132, 139, 140, 141, 142, 143, 144, 150, 152, 159S, 161, 162, 163, 164, 167S, 168S, 174, 177, 179, 180, 183S, 184, 186, 187, 189; 193, 194; 195S-196S sections 7, 17, 18, 21, 22, 23, 30, 31, 34; 201S, 202S, 234S, 239S, 247, 248, 262, 265S, 282S.

**Ancient, Medieval and Renaissance.** History 23, 25, 53, 54, 100, 103, 104, 107, 117, 125, 126, 133, 134, 138, 152, 173, 181, 182; 195S-196S sections 1, 13, 28; 221, 222, 237S, 238S, 260, 261, 263, 264, 267S.

**Medicine, Military, Science, Technology.** History 100, 101H, 118, 123S, 127S, 147, 148, 149, 151, 157, 158, 172A, 172B, 199; 195S-196S sections 4, 16; 213, 219S, 220S, 273, 274.

**Modern Europe.** History 21, 21S, 22, 22S, 23, 49S, 101C, 107, 108, 117, 119, 120, 135, 136, 137, 138, 154, 171, 173, 180, 182, 188; 195S-196S sections 2, 11, 12, 20, 26, 28, 29; 207, 208, 217S, 218S, 221, 229S, 230S, 253S, 254S, 268S, 269S, 270S.

**United States.** History 91, 91S, 92, 92S, 93S, 110, 111, 112, 113, 121, 122, 124S, 128, 129, 130, 145, 146, 150, 153S, 159S, 160, 168S, 169S, 170S, 175S, 176S, 185; 195S-196S sections 3, 5, 6, 19, 24, 25, 27, 33; 212, 215-216, 229S, 230S, 231S, 232S, 241-242, 249-250, 277S, 278S, 285S, 286S.

## THE MAJOR

*Introductory Courses.* Two introductory courses in history (21-22, 21S-22S, 23, 25-26, 53-54, 75-76, 91-92, 91S-92S, 93S).

*Major Requirements.* Eight courses in history including (1) at least two introductory courses, (2) at least one course in each of three out of the five fields described above, (3) two courses in an undergraduate seminar (195S-196S) or on the 200 level. Students are urged to register for two consecutive courses at this level, but may take two single semester

courses with consent of both instructors. Students wishing to take advanced courses in a field are advised to elect the introductory course in that field.

*Advanced Placement Credit.* Two of the eight courses needed for the major may be fulfilled by advanced placement credits. If two additional advanced placement credits have been granted they may be applied toward the thirty-two credits needed for graduation, but may not be applied to the history major.

*Foreign Languages.* Majors interested in a particular area of study benefit from knowledge of the language of that area. Majors who contemplate graduate work are reminded of the requirement of a reading knowledge of one or two foreign languages.

*Majors Planning to Teach.* Majors who plan to teach in secondary schools should consult an advisor in education. Rising juniors who intend to practice-teach in the senior year should take the 195S-196S or 197S-198S seminars or 200-level courses as juniors.

*Honors.* Any student who is qualified (see the section on honors in this bulletin) may apply to the Director of Undergraduate Studies for permission to undertake work leading to a degree with distinction in history.

## House Courses (HC)

See the chapter "Academic Procedures and Information" for information on house courses.

## Human Development Program

Professor Maddox, *Director*

A certificate, but not a major, is available in this program.

The goal of this interdisciplinary program is to broaden and enhance the perspectives of students interested in human development. The program seeks to foster an understanding and appreciation of how biological, psychosocial, and cultural factors act together in development throughout the life course; highlight the ways in which different disciplines conceptualize and study development; demonstrate the complementarity of disciplinary perspectives; and facilitate dialogue among faculty and students, illustrating the complementarity of and necessity for multidisciplinary perspectives.

Achievement of the program's goal is facilitated by an integrated curriculum of required and elective courses, a research apprenticeship, a lecture series, and other special events. An active advisory procedure assists students in planning learning opportunities. A certificate is available for students who complete program requirements. Participation in selective parts of the program and in the advisory system, however, is available to all undergraduates whether or not they seek the certificate.

The curriculum includes six courses, completion of which is required for the program certificate.

Interdisciplinary Course 124. Human Development. C-L: Psychology 124 and Sociology 124. *Maddox and staff*  
Either Psychology 159S (Biological Psychology of Human Development, *Thompson*) or Interdisciplinary Course 180. C-L: Psychology 130 and Sociology 169 (Psychosocial Aspects of Human Development, *Martin Lakin and Maddox*)

Interdisciplinary Course 190. Research Apprenticeship in Human Development. *Staff*

Interdisciplinary Course 191S. Senior Seminar in Human Development. *Staff*

Two elective courses chosen from an illustrative list of biological, psychological, and social scientific courses affiliated with the program published in the program brochure.

The research apprenticeship arranged through the program and the related senior seminar would ordinarily be available only to students seeking the program certificate. Other components of the program are available to all undergraduates.



## Interdisciplinary Courses (IDC)

**21S. Freshman Seminar: Topics in Medieval Studies.** Topics vary according to instructor: perspectives from history, literature, religion, philosophy, and the arts. C-L: Medieval and Renaissance Studies. One course. *Staff*

**22S. Freshman Seminar: Topics in Renaissance Studies.** Topics vary according to instructor: perspectives from history, literature, religion, philosophy, and the arts. C-L: Medieval and Renaissance Studies. One course. *Staff*

**103. An Introduction to Women's Studies. (SS)** Gender roles, their place in American culture, and the twentieth-century feminist movement. Use of the perspectives of the social sciences, the natural sciences, and the humanities. Emphasis on integrating the study of women, women's history, experience, and modes of expression into the traditional disciplines. C-L: Women's Studies. One course. *J. O'Barr and staff*

**104. Public Policy and the Marine Environment. (SS)** Economic, legal, medical, political, social, and scientific viewpoints on the effect of human society on the marine environment; special emphasis on coastal North Carolina. Lectures and projects. One course. *Costlow*

**106. Introduction to the Study of Literature and Society. (AL)** See C-L: Literature 101; also C-L: Comparative Area Studies. One course. *Willis*

**107S, 108S. Science, Technology, and Human Values. (SS)** Open to juniors and seniors in the Science, Technology, and Human Values Program and to other seniors if space is available. Credit by arrangement: the pair, or either 107S or 108S, may be taken for one course credit. Two half courses or one course. Prerequisite: consent of instructor. Variable credit. *Vesilind and staff*

**111. Introduction to Linguistics. (SS)** See C-L: Cultural Anthropology 107; also C-L: English 111 and Linguistics. One course. *Staff*

**112S, 113S. Topics in Science, Technology, and Human Values.** Six five-week segments offered sequentially over the fall and spring semesters by faculty of the Program in Science, Technology, and Human Values. Credit for 112S or 113S is awarded for completion of three to five segments within a single academic year; credit for 112S and 113S for completion of six segments. Students who expect to take three to five segments only are encouraged to register for 112S. One course each. *Vesilind and staff*

**114. Introduction to Medieval Studies. (CZ)** A survey of historical, literary, philosophical, and art historical materials introducing medieval culture and the methods developed for its study. C-L: History 116. One course. *Solterer, Witt, and staff*

**115. Introduction to Renaissance Studies. (CZ)** A survey of historical, literary, philosophical, and art historical materials introducing Renaissance culture and the methods developed for its study. C-L: History 148. One course. *Robisheaux, Schwartz, and staff*

**119. Current Topics in Linguistics. (SS)** See C-L: Cultural Anthropology 112; also C-L: English 119 and Linguistics. One course. *Staff*

**120. Perspectives on Food and Hunger. (SS)** Issues of food and hunger from an interdisciplinary perspective. Lectures present analytic approaches from the natural sciences, social sciences, and the humanities. Pass/fail grading only. C-L: Comparative Area Studies. Half course. *Johns*

**120A. Perspectives on Food and Hunger. (SS)** See Interdisciplinary Course 120. Lectures, weekly discussion meetings, and individual research. C-L: Comparative Area Studies and Political Science 176A. One course. *Johns*

**120B. Perspectives on Food and Hunger. (SS)** See Interdisciplinary Course 120. Lectures, community internship project, and discussion meetings. C-L: Comparative Area Studies and Political Science 176B. One course. *Johns*

**124. Human Development. (SS)** Biological, behavioral, and cultural perspectives and approaches. Evaluation of competing paradigms. Taught by multidisciplinary team. Especially for sophomores. C-L: Human Development, Psychology 124, and Sociology 124. One course. *Maddox and staff*

**139. Marxism and Society. (SS)** See C-L: Cultural Anthropology 139; also C-L: Education 139, History 186, and Sociology 139. One course. *Fox or Wilson*

**140. The Great Mother: Archetype or Stereotype? (AL)** The Jungian archetype of the Great Mother and the emerging feminist critique of the Jungian model. The dual symbolism of the Feminine as nurturing and devouring Mother, the ambivalent nature of mother-daughter relations, the identification of woman with Eros, and alternatives to the patriarchal myth of the Mother. Readings include Jungian and feminist theories; Asian, Egyptian, and Greek mythologies; and modern fiction. C-L: Comparative Area Studies and Women's Studies. One course. *Wang*

**153S. The Insurgent South. (CZ)** C-L: History 153S. One course. *Goodwyn*

**155. Comparative Perspectives on Literature and Social Change: From Plantation to City. (AL)** See C-L: Literature 155; also C-L: Comparative Area Studies. One course. *Willis*

**160S. Topics in Medieval and Renaissance Studies.** Interdisciplinary perspectives from the arts, history, literature, philosophy, and religion. For juniors and seniors and Medieval and Renaissance Studies majors, or with consent of instructor. Prerequisite: one course in Medieval and/or Renaissance periods. C-L: Medieval and Renaissance Studies. One course. *Staff*

**162, 163. Introduction to Islamic Civilization. (CZ)** Extensive survey of Muslim peoples and institutions. 162: the Middle Eastern origins and cultural attainments of medieval Islam. 163: modern developments and global features of the Islamic world. C-L: Comparative Area Studies; Cultural Anthropology 147, 148; History 101G, 102G; and Religion 162, 163. One course each. *Lawrence and staff*

**164. History and Religions of North Africa. (CZ)** See C-L: Religion 164; also C-L: Comparative Area Studies and History 187. One course. *Lawrence*

**180. Psychosocial Aspects of Human Development. (SS)** See C-L: Psychology 130; also C-L: Human Development and Sociology 169. One course. *Martin Lakin and Maddox*

**182. Media in Comparative Perspective. (SS)** Impact of mass media outside the United States. Cross-national comparisons of media content, audiences, and control. Relationships of governments to media and media policies. International flow of media materials and their cross-national impact. C-L: Comparative Area Studies, Political Science 180, and Sociology 182. One course. *Paletz or Smith*

**184. An Introduction to Canada and Canadian Issues. (SS)** A survey of the main geographic, historical, economic, governmental, and political facets that have shaped modern Canada and an examination of persistent and current issues facing the Canadian nation. C-L: Canadian Studies, Comparative Area Studies, Economics 184, History 184, Political Science 184, and Sociology 184. One course. *Cahow*

**186S. Research Internship in Primatology.** Part of the Undergraduate Program in Primatology. Supervised work either in a laboratory or at the Primate Center. Prerequisite: consent of instructor. C-L: Biological Anthropology and Anatomy 186S. One course. *Staff*

**187S. Senior Seminar in Primatology. (NS)** Part of the Undergraduate Program in Primatology. Prerequisite: consent of instructor. C-L: Biological Anthropology and Anatomy 187S. One course. *Staff*

**188S. The Diaghilev Ballet, 1909-1929. (AL)** Prerequisite: junior or senior standing or consent of instructor. See C-L: Dance 188S; also C-L: Institute of the Arts 121S. One course. *Dickinson and staff*

**190. Research Apprenticeship in Human Development.** Part of the Undergraduate Program in Human Development. Supervised work may be in a laboratory, project, or organizational setting. Prerequisite: consent of instructor. C-L: Human Development. One course. *Staff*

**191S. Senior Seminar in Human Development. (SS)** Part of the Undergraduate Program in Human Development. Prerequisite: consent of instructor. C-L: Human Development. One course. *Thompson and staff*

**195S. Senior Seminar in Women's Studies.** Original research project in feminist scholarship, applying multidisciplinary perspectives. For Women's Studies Program certificate earners. Prerequisite: consent of instructor. One course. *J. O'Barr and staff*

**200. Advanced Neuroscience I. (NS)** Prerequisite: Psychology 103. See C-L: Psychology 200; also C-L: Biology 200. One course. *Cant and McClay*

**201. Advanced Neuroscience II. (NS)** Prerequisite: Biology 200, Interdisciplinary Course 200, or Psychology 200. See C-L: Psychology 201. One course. *R. Erickson and W. G. Hall*

**211S. History of Feminist Thought. (CZ)** The intellectual history of feminist thought and an analysis of the sex/gender system from medieval through modern times. Examination of a number of classical philosophical, sociological, and literary texts. Open to advanced undergraduates with instructor's consent and to all graduate students. C-L: Women's Studies. One course. *Neuschel, J. O'Barr, or Pope*

**282S. Canada. (SS)** See C-L: History 282S; also C-L: Canadian Studies, Comparative Area Studies, Cultural Anthropology 282S, Political Science 282S, and Sociology 282S. One course. *Cahow*

**283S. Feminist Theory and the Humanities.** Beliefs about gender in the assumptions, methods, and issues of mainstream scholarship in traditional disciplines of the humanities. The impact of gender-related social and institutional circumstances on those disciplines. C-L: English 283S, Religion 269S, and Women's Studies. One course. *Clark, Orr, Pope, Sedgwick, or Tompkins*

**284S. Feminist Theory and the Social Sciences. (SS)** Examination of feminist modes of inquiry in the social sciences. The relationship of gender in economic, political, social and cultural systems and the resulting methodological shifts in social science disciplines. C-L: Cultural Anthropology 284S, History 284S, Political Science 264S, Psychology 284S, Sociology 284S, and Women's Studies. One course. *Chafe, Neuschel, O'Rand, C. Smith, or Spenner*

## COURSES CURRENTLY UNSCHEDULED

**99. Perspectives in Archaeology. (CZ)**

**101, 102. Introduction to the Civilizations of Southern Asia. (CZ)**

**170. Romanticism in the Arts. (AL)**

**189. The Americas: A Survey of the Forces Shaping the Hemisphere. (SS)**



234S. Political Economy of Development: Theories of Change in the Third World. (SS)

## Italian

For courses in Italian, see Romance Languages.

## Japanese

For courses in Japanese, see Asian and African Languages.

## Judaic Studies Program (Center for Judaic Studies)

Professor E. Meyers (religion), *Director*; Associate Professor Bland (religion), *Director of Undergraduate Studies*; Professor Wintermute (religion); Associate Professors Alt (Germanic languages and literature), Bailey (Divinity School), and C. Meyers (religion)

A program in Judaic studies may be taken as part of a major in religion or as a supplement to any other major. It may also be taken under Program II. Students are eligible for a certificate in Judaic studies after completing four courses in the program.

For descriptions of the courses consult the listings under the specified departments.

### German

181, 182. Elementary Yiddish. *Alt*

### Hebrew

1, 2. Elementary Modern Hebrew. *Staff*  
63, 64. Intermediate Modern Hebrew. *Staff*  
191, 192, 193, 194. Independent Study. *Staff*

### Religion

50. The Old Testament. *C. Meyers, E. Meyers, Peters, or Wintermute*  
51. Introduction to Judaic Civilization. *Bland or E. Meyers*  
101. Selected Studies in the Bible: Prophets. *Staff*  
102. Selected Studies in the Bible: Writings. *Staff*  
105. Theology of the Old Testament. *Wintermute*  
109. Women in the Biblical Tradition: Image and Role. *C. Meyers*  
110. Archaeology and Art of the Biblical World. *C. Meyers or E. Meyers*  
115-116. Introduction to Biblical Hebrew. *Bailey*  
131D. Principles of Archaeological Investigation. *C. Meyers or E. Meyers*  
132D. Palestine in Late Antiquity. *E. Meyers*  
133. Foundations of Post-Biblical Judaism. *E. Meyers*  
134. Jewish Mysticism. *Bland*  
135. Jewish Religious Thought. *Bland*  
136. Contemporary Jewish Thought. *Bland or E. Meyers*  
195B, 196B. Junior-Senior Seminars. *Staff*  
207, 208. Intermediate Biblical Hebrew. *Staff*  
220. Rabbinic Hebrew. *E. Meyers or staff*  
221. Readings in Hebrew Biblical Commentaries. *Bland*  
238. Jewish Responses to Christianity. *Bland*  
243. Archaeology of Palestine in Biblical Times. *C. Meyers*  
244. Archaeology of Palestine in Hellenistic-Roman Times. *E. Meyers*

Opportunities for independent study are offered in the Department of Religion under 191, 192, 193, 194. Procedures for registration and applications are available in 118 Gray Building.

Special attention is directed to those courses in New Testament which are relevant to the study of Rabbinic Judaism—Religion 106, 107, 108, and 111. A list of appropriate courses at the University of North Carolina at Chapel Hill is available in 230C Gray Building, Duke University, and in 101 Saunders Hall, University of North Carolina, Chapel Hill and may be taken under the rubric of the Cooperative Program in Judaic Studies.

## Korean

For courses in Korean, see Asian and African Languages.

## Latin

For courses in Latin, see Classical Studies.

## Linguistics Courses

Students interested in the study of language as part of their undergraduate program or as preparation for graduate work in linguistics should consult the instructors of the courses listed below or Assistant Professor Andrews, Chair, Committee on Linguistics, 314 Languages Building. Students may concentrate in linguistics through Program II. For descriptions of the following courses see the listings of the specified departments:

### Cultural Anthropology

- 107. Introduction to Linguistics. *Butters, Nygard, or Tetel*
- 112. Current Topics in Linguistics. *Staff*
- 118S. The Language of Advertising. *O'Barr*
- 119. Language, Culture, and Society. *Apte or Weller*
- 211S. Ethnography of Communication. *Apte, Domínguez, Fox, O'Barr, Quinn, Smith, or Weller*

### English

- 111. Introduction to Linguistics. *Staff*
- 112. English Historical Linguistics. *Butters, Nygard, or Tetel*
- 115. Present-Day English. *Butters, Nygard, or Tetel*
- 118S. The Teaching of Composition, Grammar, and Literature in the Secondary School. *Page*
- 119. Current Topics in Linguistics. *Staff*
- 205. Semiotics and Linguistics. *Andrews*
- 208. History of the English Language. *Butters, Nygard, or Tetel*
- 209. Present-Day English. *Butters or Nygard*

### French

- 131S. French in the New World. *Hull*
- 210. The Structure of French. *Hull*
- 211. History of the French Language. *Hull*

### German

- 205, 206. Middle High German. *Rasmussen*
- 216. History of the German Language. *Rasmussen*
- 219. Applied Linguistics. *Rasmussen*

### Interdisciplinary Courses

- 111. Introduction to Linguistics. *Staff*
- 119. Current Topics in Linguistics. *Staff*

### Philosophy

- 103. Symbolic Logic. *Brandon or Posy*
- 109. Philosophy of Language. *Posy*
- 228S. Recent and Contemporary Philosophy. *Posy*
- 250S. Topics in Formal Philosophy. *Posy*

### Psychology

- 134. Psychology of Language. *Day*
- 220S. Psycholinguistics. *Day*

### Russian

- 119. Topics in Eastern and Northern European Languages. *Pugh*
- 150. The Languages of the Soviet Union. *Pugh*
- 185S. Introduction to Slavic Linguistics. *Andrews*
- 186S. History of the Russian Language. *Pugh*
- 205. Semiotics and Linguistics. *Andrews*

## Spanish

119S. Structure of Spanish. *Staff*

210. History of the Spanish Language. *Garci-Gómez*

## Literature: Undergraduate Courses in the Literature Program (LIT)

The following courses are offered as electives for undergraduates who are interested in interdisciplinary approaches in the humanities, literary theory, film theory, or the study of non-Western literatures and cultures. Inquiries should be directed to Professor A. Patterson, 305 Carr Building, or the office of the Literature Program. For graduate courses in the Literature Program, consult the *Bulletin of Duke University: Graduate School*.

**20S. Introductions to Literature. (AL)** Introduction to the study of literature and other forms of cultural expression, such as film. Different introductory approaches will be used in each section (for example, a systematic account of literary genres, a historical survey of ideas and forms of fiction, concepts of authorship and subjectivity, or of literary meaning and interpretation). More than one national literature or culture represented. One course. *Staff*

**49S. Freshman Seminar.** Topics vary each semester offered. One course. *Staff*

**50. What Is Literature? (AL)** Introduction to the idea of literature from an innovative and questioning position, to a number of major modern thinkers, and to theory in general. The relationship of literature to history; theories of reading and interpretation; and the concepts and structures of thought associated with modernism and postmodernism. One course. *Jameson and A. Patterson*

**51. Foundations of Western Literature: Homer to Dante. (AL)** Classical and medieval texts that have defined the central topics and forms of Western literature, including the nature of love; the relation of people to their gods, to death, and to the afterlife; the values and perils of writing itself. One course. *L. Patterson*

**100. Introduction to Comparative Literature. (AL)** Basic structures of literature understood as fiction-making: the journey, the hero, the storyteller, the goal of community. Texts from the *Odyssey* to contemporary works, with an introduction to theoretical issues. One course. *Rolleston*

**101. Introduction to the Study of Literature and Society. (AL)** Literature in relation to history, social situation, and culture. Development of modes of interpretation that juxtapose textual features and broader contextual concern. Readings from Western and non-Western sources representative of a number of periods and genres. C-L: Comparative Area Studies and Interdisciplinary Course 106. One course. *Willis*

**102. Introduction to Media Studies. (AL)** See C-L: English 82; also C-L: Film and Video. One course. *Gaines and staff*

**119. The Political Stage. (AL)** The link between political issues—governance, law, ethics, economics, sexual politics—and drama. Texts represent different issues, nations, and eras, from Aeschylus to the present. C-L: Drama 119. One course. *Clum*

**121. Introduction to Non-Western Literatures. (AL)** An exploration of such themes as women, war, and the West in twentieth-century literature of East Asia, South Asia, the Middle East, North Africa, and sub-Saharan Africa. C-L: Comparative Area Studies. One course. *Cooke and Fowler*

**122. The American Imagination. (AL)** A syncretic approach to the literature of the Americas, North and South, drawing attention to the underlying homogeneity of New World culture. Borges, Faulkner, Garcia Marquez, Melville, Neruda, Thoreau, and others. One course. *Pérez Firmat*



**125. The Romantic Impulse in the Novel. (AL)** An exploration of how novels intermix realistic and romantic techniques, forms, themes, and concerns. Fictions by Emily Brontë, Stendhal, Flaubert, Dickens, Dostoevsky, Gide, Nabokov, Barth, and others. One course. *Torgovnick*

**128. Writings in the Pan-African Tradition. (AL)** Pan-Africanism as a political and cultural movement in this century. Political philosophies of black intellectuals (Garvey, Padmore, DuBois, James) as context for Negritude poetry and novels from black Africa, the Caribbean, and the United States. C-L: Women's Studies. One course. *Willis*

**129. Latin-American Literature in Translation. (AL)** See C-L: Spanish 121; also C-L: Comparative Area Studies. One course. *Fein*

**132. Dada and Surrealism. (AL)** The international dada and surrealist movement in its multiple manifestations: theater, painting, novel, film, autobiography, and manifesto. Knowledge of French or German desirable. One course. *Thomas*

**145. The Descent of the Epic. (AL)** Epic impulses and persistent themes in literary history: Homer, Vergil, Dante, Voltaire, Dostoevsky, T. S. Eliot, and Joyce. One course. *Torgovnick*

**155. Comparative Perspectives on Literature and Social Change: From Plantation to City. (AL)** Representations of rural life in North America, the Caribbean, and Latin America drawn from literary texts and sociological and historical studies. Focus on the rural family as the nexus between individual relationships and the forces of history. C-L: Comparative Area Studies and Interdisciplinary Course 155. One course. *Willis*

**156. American Popular Culture. (AL)** See C-L: English 156. One course. *Radway or Willis*

**159. Tragedy and the Tragic. (AL)** Sources, social role, and philosophical implications of tragedy from ancient Greece to Shakespeare and the Elizabethans, the classical French theater and modern times. One course. *Burian*

**177. Film Theory. (AL)** Recent critical developments in Marxist aesthetics, structuralism, semiotics of the image, feminist film theory. Both experimental and Hollywood narrative films. C-L: Film and Video and Women's Studies. One course. *Gaines*

**179. Contemporary Science Fiction. (AL)** Major writers in the tradition of Utopia and Science Fiction since the 1960s, in particular LeGuin, Dick, and Delany. The formal distinction between science fiction and fantasy, innovations in narrative structure, concepts of utopia and dystopia, and the relationship between the genre and the social history of the 1960s and 70s. One course. *Jameson*

**180. Writings in the Rural Tradition: From the Caribbean to the American South. (AL)** Comparative readings of fiction and poetry from the southern United States and the Caribbean, analyzed in relation to the plantation heritage. C-L: English 180. One course. *Willis*

**185. Psychoanalysis, Literature, and Film. (AL)** Genres, styles, and schools in film and literature that attract psychoanalytic readings and raise issues of gender and sexuality: the gothic, horror, melodrama, and romance fiction; surrealism and the avant-garde. C-L: Film and Video and Women's Studies. One course. *Gaines*

**187. Studies in Film History. (AL)** See C-L: English 185; also C-L: Drama 136 and Film and Video. One course. *Clum, Gaines, Jameson, or Moses*

**199S. Theory and Practice of Literary Translation. (AL)** Linguistic foundations and historical role of translation. Practical exercises and translation assignments. Prerequisites: working knowledge of a foreign language and consent of instructor. One course. *Burian*

## Management Sciences Courses (MS)

Professor Keller, *Chairman*; Professor Dickens, *Director of Undergraduate Studies*

The courses listed below are offered for undergraduates by the Fuqua School of Business. They are professional school courses and hence *do not count for the distributional requirements*. They fall within the limit of six professional school courses which may count for an undergraduate degree from Trinity College. A major is not offered to undergraduate students.

Taking a selection of these courses may be helpful in preparation for graduate education in business and law and may provide the liberal arts, science, and engineering student an advantage in placement. Students planning to take the accounting concentration in the Master of Business Administration Program of the Fuqua School of Business either following graduation or in the undergraduate-professional combination program should take Management Sciences 53 and 137 at a minimum.

The Director of Undergraduate Studies is available for consultation with undergraduates.

**53. Introductory Financial Accounting.** The accounting model of the firm and transactions analysis. Topics include the procedures used to process accounting data, issues in asset valuation and income determination, and financial statement analyses. Prerequisite: sophomore standing. One course. *Staff*

**120. Analysis of Organizational Behavior.** Organizations and the behavior of individuals within organizations with emphasis on environmental, structural, and human factors. Topics include socialization, work motivation, decision making, leadership, power, control, small group behavior, strategy formation, organization design, organizational culture, and effects of technology. Prerequisite: junior standing. One course. *Staff*

**137. Managerial Accounting.** The use of accounting information by management in short-term planning, control, and decision making in business enterprises. Cost accumulation, cost analysis, cost estimation, the development of standards, introduction to budgeting, and short-run decisions. Prerequisite: Management Sciences 53. One course. *Staff*

**150. Financial Management.** An overview of corporate finance, financial markets, portfolio diversification, and asset pricing. Financial instruments and how the market views them; fundamental issues and models of risk, return, and asset pricing. Cases requiring students to project short-term and long-term financial needs, to value bonds and stocks, and to critique capital budgeting techniques. Major corporate finance issues of debt and dividend policies. One course. *Staff*

**161. Marketing Management.** The role of the marketing function in business; product planning, price, promotion, and distribution as elements of a total marketing mix. Formal models in solving the marketing mix problem of the firm. Prerequisite: junior standing. One course. *Staff*

**171. Production and Operations Management.** Issues in the design, operation, and control of the process by which goods are manufactured and services delivered. Topics include work-force management, production planning and materials management, capacity and technology choice, and the combination of operations choices into a coherent strategy. Prerequisite: junior standing. One course. *Staff*

**193, 194. Independent Study.** Directed reading and research. Open only to qualified seniors with consent of instructor and Director of Undergraduate Studies. Variable credit. *Staff*

## The University Program in Marine Sciences

Professor Ramus (botany), *Acting Director*; Professor Forward (zoology), *Director of Undergraduate Student Affairs*; Professors Costlow\* (zoology), Gutknecht (cell biology), McClay† (zoology), Pilkey‡ (geology), and Searles† (botany); Associate Professors C. Bonaventura (cell biology), J. Bonaventura (cell biology), Johnson (geology), Sullivan (biochemistry), and Sutherland (zoology); Professor Emeritus Bookhout (zoology); Research Associate Professor Kirby-Smith (Marine Laboratory); Research Assistant Professors Brouwer and Rittschof (Marine Laboratory)

The interdisciplinary program in marine sciences provides students with a unique opportunity to live and study at the Duke University Marine Laboratory for a full academic semester—fall or spring or during the summer terms. The program emphasizes small class size, independent study, and integrated classroom, laboratory, and field experience. Students have daily access to modern scientific equipment, a specialized library, and the surrounding natural marine environment.

The fall and spring semesters are offered primarily for juniors and seniors. Participation in either the spring or fall semester is possible for all majors with appropriate preparation. Before attending a semester program, it is advised that students have completed introductory college courses in biology, chemistry, mathematics, and physics. Students wishing to apply to the fall or the spring semester must submit an application form which contains the written approval of their faculty advisor to the Admissions Office, Duke University Marine Laboratory, Beaufort, North Carolina 28516, prior to Duke's registration period for the desired semester. Students will be notified of the action of the Admissions Committee shortly after receipt of their application. Applications received after Duke's registration period for the desired semester will be considered if space is available.

The summer curriculum, taught in three five-week terms, includes a rich assortment of courses in the natural sciences. Attention is directed to the relatively new introductory course in marine biology (Biology 10L), designed for humanities or social sciences majors at Duke.

Applications for summer courses must contain the written approval of the student's advisor or dean, must be accompanied by a current academic transcript (transcript not required of students applying to Biology 10L) and should be submitted by the end of March to the address indicated above. Thereafter, applications will be considered if space is available.

A number of summer tuition scholarships are available on a competitive basis. Please consult the *Bulletin of Duke University: Marine Laboratory* for specific requirements and deadline dates, or contact the Admissions Office of the Marine Laboratory.

The courses below are described in the bulletin listings of the specified departments. See the most recent *Bulletin of Duke University: Marine Laboratory* and the *Duke University Official Schedule of Courses* for the current schedule of courses. For information on courses fulfilling requirements of the biology major consult the Director of Undergraduate Studies for the major.

### FALL, SPRING, OR SUMMER COURSES AT BEAUFORT

**Marine Biology.** (Biology 10L.) For students not majoring in a natural science. One course. *Kenney*

**Public Policy and the Marine Environment.** (Interdisciplinary Course 104.) Economic, legal, medical, political, social, and scientific viewpoints on the effect of human society on the marine environment; special emphasis on coastal North Carolina. Lectures and projects. One course. *Costlow*

\*On sabbatical leave 1 January-31 December 1989.

†Summer only.

‡Spring only.



**Marine Sediments.** (Geology 109S or Geology 209S.) For Geology 209S, additional requirement of term paper. One course. *Johnson*

**Behavioral Ecology.** (Biology 113L.) Prerequisite: introductory biology. One course. *Rubenstein (visiting summer faculty)*

**Biological Oceanography.** (Biology 114L.) Prerequisite: introductory biology. One course (spring); one and one-half courses (summer). *Ramus and staff*

**Biology of Marine Macrophytes.** (Biology 117L.) Prerequisites: introductory biology and chemistry. One course. *Ramus*

**Physiology of Marine Animals.** (Biology 150L.) Prerequisites: introductory biology and chemistry. One course. *Forward*

**Organization of Marine Communities.** (Biology 169L.) Prerequisites: introductory biology and Mathematics 31. One course. *Sutherland*

**Marine Invertebrate Zoology.** (Biology 176L.) Not open to students who have taken Zoology 274L. Prerequisite: introductory biology. One course (fall); one and one-half courses (summer). *Kirby-Smith*

**Independent Study.** (Biology 191, 192; Geology 191, 192, 195; Cell Biology 210; or as listed under the student's major department.) For junior and senior majors with consent of appropriate Director of Undergraduate Studies and supervising instructor. Credit to be arranged. *Staff*

**Light in the Sea.** (Biology 195S.) Half course. *Ramus*

**Marine Policy.** (Public Policy Studies 195S.) One course. *Orbach (visiting summer faculty)*

**Beach and Island Geological Processes.** (Geology 196S.) Half course. *Pilkey*

**Physical Oceanography.** (Geology 203.) Prerequisite: Physics 41 or 51. Half course. *Johnson*

**Marine Ecology.** (Biology 203L.) Prerequisites: course in introductory ecology, invertebrate zoology, or marine botany (phycology); knowledge of statistics helpful. One and one-half courses. *Hay (visiting summer faculty)*

**Barrier Island Ecology.** (Biology 218 or Forestry and Environmental Studies 218.) Prerequisite: a course in general ecology. One and one-half courses. *Staff*

**Benthic Marine Algae.** (Biology 219L.) Prerequisite: introductory biology; plant diversity recommended. One course. *Schneider (visiting summer faculty)*

**Tropical Seaweeds.** (Biology 263L.) Two-week field study. Prerequisites: Biology 145L or equivalent or consent of instructor. Half course. *Searles*

**Marine Invertebrate Zoology.** (Biology 274L.) Not open to students who have had Biology 76L or 176L. Prerequisite: introductory biology. One and one-half courses. *Ruppert (visiting summer faculty)*

**Invertebrate Developmental Biology.** (Biology 278L.) Prerequisite: consent of instructor. One and one-half courses. *McClay and visiting staff*

**Advanced Topics in Geology: Continental Margin Sedimentation.** (Geology 295S.) Prerequisite: Geology 206S or consent of instructor. One course. *Johnson and visiting staff*

**Marine Animal Navigation.** (Biology 295S.) Half course. *Forward*

**Experimental Ecology of the Marine Intertidal Zone.** (Biology 296S.) Half course. *Sutherland*

**Analysis of Coastal Ecosystems.** (Biology 296S.) One course. *Costlow*

**The Ecology of Chemical Signals.** (Biology 296S.) Half course. *Rittschof*

#### COURSES CURRENTLY UNSCHEDULED

**Macromolecules, Ecology, and Evolution.** (Biochemistry 245L.)

**Marine Biochemistry and Genetics.** (Biochemistry 266S.)

**Comparative and Evolutionary Biochemistry.** (Biochemistry 276L.)

**Natural History of Coastal Marine Systems.** (Biology 295S.)

**Marine Fishes: Selected Topics.** (Biology 296S.)

## Mathematics (MTH)

Professor Reed, *Chairman*; Associate Professor Lawler, *Director of Undergraduate Studies*; Instructor Blake, *Supervisor of Freshman Instruction*; Professors Allard, Beale, Bryant, Griffiths, Rose, Schaeffer, Shoenfield, Warner, and Weisfeld; Associate Professors Burdick, R. Hodel, Kitchen, Kraines, Moore, Morrison, Pardon, Saper, Scoville, Smith, Stern, and Venakides; Assistant Professors Gardner, Layton, Nance, Papanicolaou, and Schoen; Professors Emeriti Carlitz, Dressel, Elliott, Hickson, Murray, and Roberts; Adjunct Professor Chandra; Visiting Associate Professor Pittie; Visiting Assistant Professor Edelstein-Keshet; Instructor Bookman; Part-time Instructors M. Hodel and Sager; Lecturer Israel

A major is available in this department.

**9-10. Preparatory and Precalculus Mathematics.** A two-semester skills course for students who need to review topics in high school mathematics while covering the material in Mathematics 19. Students whose mathematics SAT scores are 500 or below, or whose CEB Mathematics Level I or II Achievement Test scores are 480 or below, need this two-semester course before taking Mathematics 31. No credit for Mathematics 9 without successful completion of Mathematics 10. Not open to students who take Mathematics 19. Prerequisite: for 10, Mathematics 9. One course. *Staff*

**19. Precalculus Mathematics.** Selected topics in algebra, trigonometry, and analytic geometry. Students with achievement scores in mathematics below 550 need this skills course before taking Mathematics 31. Not open to students who take Mathematics 10. Prerequisite: two units of college preparatory mathematics. One course. *Staff*

**31. Introductory Calculus I. (QR)** Functions, limits, continuity, trigonometric functions, techniques and applications of differentiation, indefinite and definite integrals, the fundamental theorem. One course. *Staff*

**31X, 32X. Introductory Honors Calculus I and II. (QR)** Similar to Mathematics 31 and 32, but faster paced and more challenging. Open to students who score at least 750 on the SAT Mathematics Aptitude Test. One course each. *Staff*

**32. Introductory Calculus II. (QR)** Transcendental functions, techniques and applications of integration, indeterminate forms, improper integrals, infinite series. Not open to students who have had Mathematics 34, 36, or 41. Prerequisite: Mathematics 31 or 33. One course. *Staff*

**33, 34. Introductory Calculus with Digital Computation. (QR)** Same as 31, 32 but these courses meet one additional hour per week to discuss the solution of calculus problems using the computer. No programming experience required. Prerequisites: for 34, Mathematics 33 or 31 and consent of instructor. One course each. *Staff*

**41. One Variable Calculus. (QR)** Meets five times a week, quickly reviews differential calculus and then covers integral calculus and infinite series. Designed for freshmen who have had a year of calculus in high school and have Mathematics SAT scores of 650 or above, but who have not received advanced placement credit for Mathematics 31. Not open to students who have had Mathematics 31, 32, 33, 34, or 36. One and one-half courses. *Staff*

**49S. Freshman Seminar.** Topics vary each semester offered. One course. *Staff*

**71S. Special Topics in Mathematics: For Freshmen and Sophomores. (QR)** Selected topics from problem solving, number theory, geometry, topology, mathematical logic, and other areas of mathematics. Prerequisite: consent of instructor. One course. *Staff*

**103. Intermediate Calculus. (QR)** Partial differentiation, multiple integrals, topics in differential and integral vector calculus. Prerequisite: Mathematics 32, 34, or 41. One course. *Staff*

**103X, 104X. Honors Intermediate Calculus and Linear Algebra. (QR)** Similar to Mathematics 103, 104, but more theoretical. Students who have taken 31X, 32X are encouraged to enroll. Students continuing from 103X should take 104X rather than 104. One course each. *Staff*

**104. Linear Algebra and Applications. (QR)** Systems of linear equations and elementary row operations, Euclidean  $n$ -space and subspaces, linear transformations and matrix representations, Gram-Schmidt orthogonalization process, determinants, eigenvectors and eigenvalues; applications. Prerequisite: Mathematics 32, 34, 36, or 41. One course. *Staff*

**111. Applied Mathematical Analysis I. (QR)** First and second order differential equations with applications; matrices, eigenvalues, and eigenvectors; linear systems of differential equations; Fourier series and applications to partial differential equations. Intended primarily for engineering and science students with emphasis on problem solving. Not open to students who have had Mathematics 131. Prerequisite: Mathematics 103. One course. *Staff*

**114. Applied Mathematical Analysis II. (QR)** Boundary value problems, complex variables, Cauchy's theorem, residues, Fourier transform, applications to partial differential equations. Not open to students who have had Mathematics 181 or 230. Prerequisites: Mathematics 111 or 131, or 103 and consent of instructor. One course. *Staff*

**121. Introduction to Abstract Algebra. (QR)** Groups, rings, and fields. Students intending to take a year of abstract algebra should take Mathematics 200 and 201. Not open to students who have had Mathematics 200. One course. *Staff*

**123S. Geometry. (QR)** Euclidean geometry, inversive and projective geometries, topology (Möbius strips, Klein bottle, projective space), and non-Euclidean geometries in two and three dimensions. Prerequisite: Mathematics 32 or 34 or 41, or consent of instructor. One course. *Staff*

**124. Combinatorics. (QR)** Permutations and combinations, generating functions, recurrence relations; topics in enumeration theory, including the Principle of Inclusion-Exclusion and Polya Theory; topics in graph theory, including trees, circuits, and matrix representations; applications. Prerequisite: Mathematics 104 or 106 or consent of instructor. One course. *Staff*

**126. Introduction to Linear Programming and Game Theory. (QR)** Fundamental properties of linear programs; linear inequalities and convex sets; primal simplex method, duality; integer programming; two-person and matrix games. Prerequisites: Mathematics 32 or 34 or 41, and 103 and 104 or consent of instructor. One course. *Staff*

**128. Number Theory. (QR)** Divisibility properties of integers, prime numbers, congruences, quadratic reciprocity, number-theoretic functions, simple continued fractions, rational approximations. Prerequisite: Mathematics 32 or 34 or 41 or consent of instructor. One course. *Staff*

**131. Elementary Differential Equations. (QR)** Solution of differential equations of elementary types; formation and integration of equations arising in applications. Not open to students who have had Mathematics 111. Prerequisite: Mathematics 103; corequisite: Mathematics 104. One course. *Staff*

**132S. Qualitative Theory of Ordinary Differential Equations. (QR)** Qualitative behavior of general systems of ordinary differential equations, with application to biological and ecological systems, oscillations in biochemistry, electrical networks, and the theory of deterministic epidemics. Prerequisite: Mathematics 131 or 111 or consent of instructor. One course. *Staff*



**135. Probability. (QR)** Probability models, random variables with discrete and continuous distributions. Independence, joint distributions, conditional distributions. Expectations, functions of random variables, central limit theorem. Prerequisite: Mathematics 103. One course. *Staff*

**136. Statistics. (QR)** Sampling distributions, point and interval estimation, maximum likelihood estimators. Tests of hypotheses, the Neyman-Pearson theorem. Bayesian methods. Not open to students who have had Statistics 100 or 200. Prerequisites: Mathematics 104 and 135. One course. *Staff*

**139. Advanced Calculus I. (QR)** Algebraic and topological structure of the real number system; rigorous development of one-variable calculus including continuous, differentiable, and Riemann integrable functions and the Fundamental Theorem of Calculus; uniform convergence of a sequence of functions. Not open to students who have had Mathematics 203. Prerequisite: Mathematics 103. One course. *Staff*

**150. Topics in Mathematics from a Historical Perspective. (QR)** Content of course determined by instructor. Prerequisite: Mathematics 139 or 203 or consent of instructor. One course. *Staff*

**150S. Topics in Mathematics from a Historical Perspective. (QR)** Same as Mathematics 150, but offered as a seminar. One course. *Staff*

**160. Mathematical Numerical Analysis. (QR)** Zeros of functions; polynomial interpolation and splines; numerical integration and differentiation; applications to ordinary differential equations; numerical linear algebra; error analysis; extrapolation and acceleration. Not open to students who have had Computer Science 121 or 221. Satisfies the prerequisite for Computer Science 222 and 223. Prerequisites: Mathematics 103 and 104 and knowledge of an algorithmic programming language, or consent of instructor. One course. *Staff*

**160S. Mathematical Numerical Analysis. (QR)** Same as Mathematics 160, but offered as a seminar. One course. *Staff*

**171S. Elementary Topology. (QR)** Metric spaces and topological spaces; basic topological properties including compactness and connectedness; Brouwer fixed point theorem for  $n=2$ , classification theorem for compact, connected, 2-manifolds. Prerequisites: Mathematics 103 and 104. One course. *Staff*

**181. Complex Analysis. (QR)** Complex numbers, analytic functions, complex integration, Taylor and Laurent series, theory of residues, argument maximum principles, conformal mapping. Not open to students who have had Mathematics 114. Prerequisite: Mathematics 139 or 203. One course. *Staff*

**187. Introduction to Mathematical Logic. (QR)** Propositional calculus; predicate calculus. Gödel completeness theorem, applications to formal number theory, incompleteness theorem, additional topics in proof theory or computability. Prerequisites: Mathematics 103 and 104 or Philosophy 103. One course. *Staff*

**191, 192. Independent Study.** Directed reading and research. Admission by consent of instructor and Director of Undergraduate Studies. One course each. *Staff*

**193, 194. Independent Study.** Same as 191, 192, but for seniors. One course each. *Staff*

**196S. Seminar in Mathematical Model Building. (QR)** Real models, mathematical models, axiom systems as used in model building, deterministic and stochastic models, linear optimization, competition, graphs and networks, growth processes, evaluation of models. Term project: model of a nonmathematical problem. Prerequisites: Mathematics 103 and 104. One course. *Staff*

## For Seniors and Graduates

**200. Introduction to Algebraic Structures I. (QR)** Laws of composition, groups, rings; isomorphism theorems; axiomatic treatment of natural numbers; polynomial rings; division and Euclidean algorithms. Not open to students who have had Mathematics 121. Prerequisite: Mathematics 104 or equivalent. One course. *Staff*

**201. Introduction to Algebraic Structures II. (QR)** Vector spaces, matrices and linear transformations, fields, extensions of fields, construction of real numbers. Prerequisite: Mathematics 200, or Mathematics 121 and consent of instructor. One course. *Staff*

**203. Basic Analysis I. (QR)** Topology of  $R^n$ , continuous functions, uniform convergence, compactness, infinite series, theory of differentiation, and integration. Not open to students who have had Mathematics 139. Prerequisite: Mathematics 104. One course. *Staff*

**204. Basic Analysis II. (QR)** Inverse and implicit function theorems, differential forms, integrals on surfaces, Stokes' theorem. Not open to students who have had Mathematics 140. Prerequisite: Mathematics 203. One course. *Staff*

**205. Topology. (QR)** Elementary topology, surfaces, covering spaces, Euler characteristic, fundamental group, homology theory, exact sequences. Prerequisite: Mathematics 104. One course. *Staff*

**206. Differential Geometry. (QR)** Geometry of curves and surfaces, the Serret-Frenet frame of a space curve, the Gauss curvature, Cadazzi-Mainardi equations, the Gauss-Bonnet formula. Prerequisite: Mathematics 104. One course. *Staff*

**221. Numerical Analysis. (QR)** Prerequisites: knowledge of an algorithmic programming language, intermediate calculus including some differential equations, and Mathematics 104. See C-L: Computer Science 221. One course. *Gardner, Greenside, or Szyld*

**222. Numerical Differential Equations. (QR)** Prerequisite: Computer Science 221. See C-L: Computer Science 222. One course. *Gardner, Greenside, Rose, or Szyld*

**223. Numerical Linear Algebra. (QR)** See C-L: Computer Science 223. One course. *Gardner, Greenside, Rose, or Szyld*

**230. Mathematical Methods in Physics and Engineering I. (QR)** Heat and wave equations, initial and boundary value problems, Fourier series, Fourier transforms, potential theory. Not open to students who have had Mathematics 114. Prerequisites: Mathematics 103 and 104 or equivalents. One course. *Staff*

**231. Mathematical Methods in Physics and Engineering II. (QR)** Green's functions, partial differential equations in several space dimensions. Complex variables, analytic functions, Cauchy's theorem, residues, contour integrals. Other topics may include method of characteristics, perturbation theory, calculus of variations, or stability of equilibria. Prerequisite: Mathematics 114 or 230. One course. *Staff*

**233. Asymptotic and Perturbation Methods.** Asymptotic solution of linear and nonlinear ordinary and partial differential equations. Asymptotic evaluation of integrals. Singular perturbation. Boundary layer theory. Multiple scale analysis. Prerequisite: Mathematics 114 or equivalent. One course. *Staff*

**238, 239. Topics in Applied Mathematics. (QR)** Conceptual basis of applied mathematics, combinatorics, graph theory, game theory, mathematical programming, or numerical solution of ordinary and partial differential equations. Prerequisites: Mathematics 103 and 104 or equivalents. One course each. *Staff*

**240. Applied Stochastic Processes. (QR)** Applications of probability theory and stochastic processes to economics and environmental science. Markoff chains, optional

stopping, queuing theory, decision theory, birth and death processes, and the Monte Carlo method. Prerequisite: Mathematics 135 or equivalent. C-L: Statistics 240. One course. *Staff*

**241. Linear Models. (QR)** Prerequisite: Statistics 200 or equivalent. See C-L: Statistics 241. One course. *Staff*

**242. Multivariate Statistics. (QR)** Prerequisite: Mathematics 241 or Statistics 241 or equivalent. See C-L: Statistics 242. One course. *Staff*

**245. Functional Analysis for Scientific Computing. (QR)** See C-L: Computer Science 245. One course. *Rose or Szyld*

**251. Set Theory I. (QR)** Zermelo-Fraenkel axioms, ordinals and cardinals, models of set theory, constructible sets. Prerequisite: Mathematics 187 or 200 or equivalent. One course. *Staff*

**252. Set Theory II. (QR)** Forcing, large cardinals, determinateness, and other advanced topics. Prerequisite: Mathematics 251. One course. *Staff*

**253. Recursion Theory.** Register and Turing machines; recursive functions and sets; enumeration theorems; recursively enumerable sets; arithmetical and analytic hierarchies; degrees; unsolvable problems; complexity theory. Prerequisite: Mathematics 187 or Mathematics 200 or equivalent. One course. *Staff*

**258, 259. Topics in Logic. (QR)** Model theory, recursion theory, set theory, or other fields of logic. Prerequisite: Mathematics 250 or equivalent. One course each. *Staff*

**260. Groups, Rings, and Fields. (QR)** Groups including nilpotent and solvable groups,  $p$ -groups and Sylow theorems; rings and modules including classification of modules over a PID and applications to linear algebra; fields including extensions and Galois theory. Prerequisite: Mathematics 201 or equivalent. One course. *Staff*

**261. Commutative Algebra. (QR)** Extension and contraction of ideals, modules of fractions, primary decomposition, integral dependence, chain conditions, affine algebraic varieties, Dedekind domains, completions. Prerequisite: Mathematics 260 or equivalent. One course. *Staff*

**268. Topics in Algebra. (QR)** Algebraic number theory, algebraic  $K$ -theory, homological algebra, or topological algebra. Prerequisite: Mathematics 260. One course. *Staff*

**271. Algebraic Topology. (QR)** Fundamental group and covering spaces, homology groups of cell complexes, classification of compact surfaces, the cohomology ring and Poincaré duality for manifolds. Prerequisites: Mathematics 171S and 200 or equivalents. One course. *Staff*

**273. Algebraic Geometry.** Local theory: affine varieties, algebraic and topological theory of singularities. Global theory over the complex numbers: Riemann surfaces, Jacobians, Kähler manifolds, Hodge theory, theorems of Lefschetz and Kodaira. Prerequisite: Mathematics 261 or equivalent. One course. *Staff*

**275. Differential Geometry. (QR)** Differentiable manifolds, fiber bundles, connections, curvature, characteristic classes, Riemannian geometry including submanifolds and variations of the length integral, complex manifolds, homogeneous spaces. Prerequisites: Mathematics 204 and 260 or equivalents. One course. *Staff*

**276. Topics in Differential Geometry. (QR)** Lie groups and related topics, Hodge theory, index theory, minimal surfaces, Yang-Mills fields, exterior differential systems, several complex variables. Prerequisite: Mathematics 275 or consent of instructor. One course. *Staff*



**277. Topics in Algebraic Geometry. (QR)** Projective varieties and the theory of extremal rays, classification of surfaces and higher-dimensional varieties, variation of Hodge structure and moduli problems, schemes and arithmetic varieties, or other advanced topics. Prerequisite: Mathematics 273 or consent of instructor. One course. *Staff*

**278. Topics in Topology. (QR)** Point set, algebraic, geometric, or differential topology. Prerequisite: consent of instructor. One course. *Staff*

**281. Real Analysis I. (QR)** Measures; Lebesgue integral;  $L^p$  spaces; Daniell integral, differentiation theory, product measures. Prerequisite: Mathematics 204 or equivalent. One course. *Staff*

**282. Real Analysis II. (QR)** Metric spaces, fixed point theorems, Baire category theorem, Banach spaces, fundamental theorems of functional analysis, Fourier transform. Prerequisite: Mathematics 281 or equivalent. One course. *Staff*

**284. Topics in Functional Analysis. (QR)** Advanced spectral analysis, operator algebras, nonlinear functional analysis, or structure theory of Banach spaces. Prerequisite: Mathematics 282 or equivalent. One course. *Staff*

**285. Complex Analysis. (QR)** Complex calculus, conformal mapping, Riemann mapping theorem, Riemann surfaces. Prerequisite: Mathematics 204 or equivalent. One course. *Staff*

**286. Topics in Complex Analysis. (QR)** Geometric function theory, function algebras, several complex variables, uniformization, or analytic number theory. Prerequisite: Mathematics 285 or equivalent. One course. *Staff*

**290. Probability. (QR)** Random variables, independence, expectations, laws of large numbers, central limit theorem, Markoff chains. Prerequisite: Mathematics 281 or equivalent. One course. *Staff*

**293. Topics in Probability Theory. (QR)** Ergodic theory, multiparameter stochastic processes and random fields, stochastic control theory, or stochastic differential equations. Prerequisite: Mathematics 290 or consent of instructor. One course. *Staff*

**295. Fourier Analysis and Distribution Theory. (QR)** Tempered distributions, Fourier transforms, classical inequalities, and oscillatory integrals. Prerequisites: Mathematics 204 and 285 or equivalents. One course. *Staff*

**296. Ordinary Differential Equations. (QR)** Existence and uniqueness theorems for nonlinear systems, well-posedness, two-point boundary value problems, phase plane diagrams, stability, dynamical systems, and strange attractors. Prerequisites: Mathematics 104, 111 or 131, and 203 or 139. One course. *Staff*

**297. Partial Differential Equations I. (QR)** Fundamental solutions of linear partial differential equations, hyperbolic equations, characteristics, Cauchy-Kowalevski theorem, propagation of singularities. Prerequisite: Mathematics 204 or equivalent. One course. *Staff*

**298. Partial Differential Equations II. (QR)** Elliptic boundary value problems, regularity theorems, the diffusion equation, and nonlinear equations. Prerequisite: Mathematics 297 or equivalent. One course. *Staff*

**299. Topics in Partial Differential Equations. (QR)** Hyperbolic conservation laws, pseudo-differential operators, variational inequalities, theoretical continuum mechanics. Prerequisite: Mathematics 298 or equivalent. One course. *Staff*

## COURSES CURRENTLY UNSCHEDULED

**31P, 32P. Preceptorial. (QR)**

- 36. Calculus for the Social Sciences. (QR)
- 72S. Special Topics in Mathematics: For Freshmen and Sophomores. (QR)
- 103P. Preceptorial. (QR)
- 104P. Preceptorial. (QR)
- 105. Intermediate Calculus with Digital Computation. (QR)
- 106. Linear Algebra with Digital Computation. (QR)
- 135P, 136P. Preceptorial. (QR)
- 140. Advanced Calculus II. (QR)
- 140S. Advanced Calculus II. (QR)
- 197S. Seminar in Mathematics. (QR)
- 198S, 199S. Honors Seminar in Mathematics. (QR)
- 234. Mathematics for Quantum Mechanics. (QR)
- 235. Topics in Mathematical Physics. (QR)
- 250. Introductory Mathematical Logic. (QR)
- 279. Topics in Topology. (QR)
- 280. Differential Analysis. (QR)
- 283. Linear Operators. (QR)
- 288, 289. Topics in Analysis. (QR)
- 294. Topics in Probability. (QR)

## THE MAJOR

The Department of Mathematics publishes a handbook to guide majors in selecting courses for various areas of interest. A copy may be obtained from the Director of Undergraduate Studies.

*For students matriculating in the fall 1989 semester and thereafter:*

### For the A.B. Degree

*Prerequisites:* Mathematics 103 and 104 or the equivalent. (Many upper level mathematics courses assume programming experience at the level of Computer Science 10. Students without computer experience are encouraged to take Computer Science 51 or 53.)

*Major Requirements:* Six courses in mathematics numbered above 111 including Mathematics 121 or 200 and Mathematics 139 or 203.

### For the B.S. Degree

*Prerequisites:* Mathematics 103 and 104 or the equivalent. (Many upper level mathematics courses assume programming experience at the level of Computer Science 10. Students without computer experience are encouraged to take Computer Science 51 or 53.)

*Major Requirements:* Eight courses in mathematics numbered above 111 including: Mathematics 121 or 200; Mathematics 139 or 203; and one of Mathematics 136, 140, 181, 204, 205. Also, Physics 51, 52 or Physics 41, 42.

*For students matriculating before the fall 1989 semester:*

### **For the A.B. Degree**

*Prerequisites.* Mathematics 103 and 104 or equivalent courses.

*Major Requirements.* Six courses in mathematics numbered above 106, including either Mathematics 139 or Mathematics 203 and 204. At most two of the following courses may be counted: Computer Science 121, 125; Statistics 100, 200; approved courses taken at another area university while in residence at Duke.

### **For the B.S. Degree**

*Prerequisites.* Mathematics 103 and 104 or equivalent courses.

*Major Requirements.* Eight courses in mathematics numbered above 106, including (1) either Mathematics 139 or Mathematics 203, 204; and (2) one of the sequences 135, 136; 160 (or 221), 222 (or 223); 200, 201; 205 (or 171S), 206; 230, 231. At most three of the following courses may be counted: Computer Science 121, 125; Statistics 100, 200; approved courses taken at another area university while in residence at Duke. Students must also meet an area of concentration requirement by (1) satisfying the major requirement of any discipline other than mathematics or by (2) completing a program of four mathematically related courses approved by the Director of Undergraduate Studies.

### **Honors**

The department offers a program for graduation with distinction for majors under the curriculum affecting students who matriculated before May 1988 and a program for Latin honors by honors project for students who matriculated thereafter. See the section on honors in this bulletin and also the *Handbook for Majors*.

## **School of Medicine—Basic Science Courses Open to Undergraduates**

Qualified students in arts and sciences may select courses from the following offered by the graduate departments associated with the School of Medicine. A major is not offered to undergraduates in any of the departments listed below. For permission to register for these courses and for further information, see Professors Webster (biochemistry), Padilla (cell biology), Willett (microbiology and immunology), or Bigner (pathology). The 200-level courses below are described in the *Bulletin of Duke University: Graduate School*.

### **Biochemistry (BCH)**

209, 210. Independent Study. One or two courses. *Staff*

215. Genetic Mechanisms. Prerequisite: introductory biochemistry. C-L: The University Program in Genetics.

One course. *Webster and staff*

219. Molecular and Cellular Bases of Differentiation. C-L: Cell Biology 219, Microbiology and Immunology 219, and Pathology 219. One course. *Counce and staff*

222. Structure of Biological Macromolecules. Half course. *Richardson*

227. Introductory Biochemistry I: Intermediary Metabolism. Prerequisite: organic chemistry. One course. *Fridovich and Rajagopalan*

259. Molecular Biology I: Protein and Membrane Structure/Function. Prerequisite: introductory biochemistry or consent of instructor. C-L: Biochemistry 259, Cell Biology 259, Microbiology and Immunology 259, and The University Program in Cell and Molecular Biology. One course. *Erickson and staff*

265S, 266S. Seminar. Topics and instructors announced each semester. Half course or variable. *Staff*

268. Molecular Biology II: Nucleic Acids. Prerequisites: introductory biochemistry and Biochemistry 259 or consent of instructor. C-L: Microbiology and Immunology 268. One course. *Modrich and staff*

291. Physical Biochemistry. Prerequisites: Chemistry 161 and 162 or equivalents. One course. *Hsieh and staff*

297. Intermediary Metabolism. One course. *Siegel and staff*

### **Courses Currently Unscheduled**

228. Introductory Biochemistry II: Biological Macromolecules



- 245L. Macromolecules, Ecology, and Evolution  
276L. Comparative and Evolutionary Biochemistry

### Cell Biology (CBI)

- All courses require the consent of the Director of Undergraduate Studies.  
191, 192, 193, 194. Independent Study. Open to qualified juniors and seniors with consent of instructor. No more than three of these may be taken for credit. Four courses. *Staff*  
200. Medical Physiology. Limited to students whose training requires knowledge of human physiology as it pertains to medicine. Four lectures, one conference, and one clinical correlation per week. Open to undergraduates only with consent of course leader. Students may take either 200 or 203-204, but not both, for credit. One course. *Somjen and staff*  
203. Introduction to Modern Physiology. Consent of instructor required. Students may take either 200 or 203-204, but not both, for credit. One course. *Blum and staff*  
204. Introduction to Modern Physiology. (Continuation of 203.) Consent of instructor required. One course. *Blum and staff*  
205. Design and Analysis of Biological Experiments. Half course. *Lobaugh*  
217. Membrane Transport. Physical chemistry is recommended. Prerequisite: consent of instructor. Spring. One course. *Mandel*  
219. Molecular and Cellular Bases of Differentiation. C-L: Biochemistry 219, Microbiology and Immunology 219, and Pathology 219. One course. *Counce and staff*  
220. Developmental Biology. Prerequisite: a course in genetics or cell biology. One course. *Counce*  
225. Neurobiology of Sensory Systems. Prerequisite: consent of instructor. One course. *Corless, Simon, and guest lecturers*  
230. Cytoskeleton and Cell Motility. Half course. *Bennett, Erickson, and Schlossman*  
232. Extracellular Matrix and Cell Adhesion. Half course. *Bennett, Erickson, and Lightner*  
233. Introduction to Biomedical Simulation. Prerequisites: calculus; prior computer or programming experience NOT required. One course. *Kootsey and staff*  
234. Methods in Physiological Simulation. Prerequisites: a course in physiology and knowledge of a high-level computer language, or consent of instructor. One course. *Magid and staff*  
236. Seminar on the Cellular and Molecular Biology of Skeletal Muscle. One course. *Schachat*  
259. Molecular Biology I: Protein and Membrane Structure/Function. Prerequisite: consent of instructor. C-L: Biochemistry 259, Microbiology and Immunology 259, and the University Program in Cell and Molecular Biology. One course. *Erickson and staff*  
269. Advanced Cell Biology. C-L: Biology 269, Microbiology and Immunology 269, and the University Program in Cell and Molecular Biology 269. One course. *Erickson and staff*

### Microbiology and Immunology (MIC)

- 209, 210. Independent Study. A laboratory or library project. Prerequisite: consent of Director of Undergraduate Studies and instructor. Credit to be arranged. *Staff*  
214. Fundamentals of Electron Microscopy. Prerequisites: introductory biology and consent of instructor. One course. *Miller*  
219. Molecular and Cellular Bases of Differentiation. C-L: Biochemistry 219, Cell Biology 219, Microbiology and Immunology 219, and Pathology 219. One course. *Counce and staff*  
221. Medical Microbiology. Prerequisite: consent of instructor. One course. *Joklik and staff*  
221L. Medical Microbiology. Prerequisite: consent of instructor. One and one-half courses. *Joklik and staff*  
244. Principles of Immunology. An introduction to the molecular and cellular basis of the immune response. Topics include anatomy of the lymphoid system, lymphocyte biology, antigen-antibody interactions, humoral and cellular effector mechanisms, and control of immune responses. Prerequisites: Biology 160 and Chemistry 152 and consent of instructor. C-L: Biology 244. One course. *Amos, McClay, and staff*  
246S. Parasitic Diseases. Prerequisites: Microbiology 244 or 291, and Biochemistry 227 or equivalent. One course. *Balber*  
259. Molecular Biology I: Protein and Membrane Structure/Function. Prerequisite: introductory biochemistry or consent of instructor. C-L: Biochemistry 259, Cell Biology 259, Microbiology and Immunology 259, and the University Program in Cell and Molecular Biology. One course. *Erickson and staff*  
268. Molecular Biology II: Nucleic Acids. Prerequisites: introductory biochemistry and Microbiology 259 or consent of instructor. C-L: Biochemistry 268. One course. *Modrich and staff*  
269. Advanced Cell Biology. Prerequisite: introductory cell biology or consent of instructor. C-L: Biology 269, Cell Biology 269, Microbiology and Immunology 269, and the University Program in Cell and Molecular Biology. One course. *Erickson and staff*

### Courses Currently Unscheduled

234. Introduction to Biostatistical Methods

### Pathology (PTH)

- All courses require consent of instructor and Director of Graduate Studies.  
210. Independent study. Prerequisite: senior standing. Credit to be arranged. *Staff*  
219. Molecular and Cellular Bases of Differentiation. C-L: Biochemistry 219, Cell Biology 219, and Microbiology and Immunology 219. One course. *Counce and staff*

258. Cellular and Subcellular Pathology. Half course. *Shelburne and Sommer*  
275. Fundamentals of Electron Microscopy and Biological Microanalysis. One course. *Brody, Ingram, Shelburne, and Sommer*

## Medieval and Renaissance Studies Program

Professor L. Patterson, *Chairman*; Professor Witt, *Director of Undergraduate Studies*

A major is available in this program.

The program in Medieval and Renaissance Studies is designed to provide the student with a well-rounded understanding of the historical, cultural, and social forces that shaped the medieval and Renaissance periods. The program is divided into four areas of study: fine arts (art and musicology); history; language and literature (English, French, German, Greek, Italian, Latin, and Spanish); and philosophy-religion. An interdisciplinary major is offered. See the section on the major below.

The courses listed below are among those now available in the program, and they are described under the listings of the specified departments.

### Art and Art History

132. Romanesque Art. *Bruzelius*  
133. Gothic Art. *Bruzelius*  
134. Medieval Architecture. *Bruzelius*  
135. Gothic Cathedrals. *Bruzelius*  
136. Gothic Cathedrals. Taught in French. *Bruzelius*  
141. Fifteenth-Century Italian Art. *Spencer*  
142. Sixteenth-Century Italian Art. *Spencer*  
145. Renaissance Art in Florence. *Spencer*  
146. Italian Renaissance Architecture. *Spencer*  
148. Art of the Netherlands in the Fifteenth Century. *Van Migroet*  
152. Art of the Netherlands in the Sixteenth Century. *Van Migroet*  
230S. Medieval and Byzantine Art and Architecture. *Wharton*  
232S. Romanesque and Gothic Art and Architecture. *Bruzelius*  
242S. Studies in Italian Renaissance Art. *Spencer*

### Classical Studies

117. Ancient Mythographers. *Newton*

### Drama

126. French Drama of the Seventeenth Century. C-L: French 148. *Staff*

### English

121. Medieval English Literature to 1500. *Nygaard or L. Patterson*  
122. Sixteenth-Century English Literature. *DeNeef, Fish, A. Patterson, Randall, or Schwartz*  
123. English Literature: 1600 to 1660. *DeNeef, Fish, A. Patterson, Randall, or Schwartz*  
141. Chaucer. *DeNeef, Nygaard, or L. Patterson*  
143, 144. Shakespeare. *DeNeef, Gopen, Jackson, Jones, A. Patterson, Porter, Randall, or G. Williams*  
145. Milton. *Fish, A. Patterson, Price, or Schwartz*  
208. History of the English Language. *Butters, Nygaard, or Tetel*  
212. Middle English Literature: 1100 to 1500. *Fish, Gopen, Nygaard, or L. Patterson*  
221. Renaissance Prose and Poetry: 1500 to 1660. *DeNeef, Fish, A. Patterson, Randall, Schwartz, or G. Williams*  
225. Renaissance Drama: 1500 to 1642. *A. Patterson, Randall, or G. Williams*

### French

- 145S. Topics in Renaissance Literature and Culture. *Tetel*  
146S. Montaigne and Self-Portraiture. *Tetel*  
148. French Drama of the Seventeenth Century. *Farrell*  
211. History of the French Language. *Hull*  
248. French Literature of the Seventeenth Century. *Farrell*

### German

- 205, 206. Middle High German. *Rasmussen*  
215S. Seventeenth-Century Literature. *Borchardt*  
216. History of the German Language. *Rasmussen*  
217S. Renaissance and Reformation Literature. *Borchardt*

## History

- 104. The Intellectual Life of Europe, 1250-1600. *Robisheaux or Witt*
- 107. Social and Cultural History of England. *Cell or Herrup*
- 116. Introduction to Medieval Studies. *Solterer, Witt, and staff*
- 117. Early Modern Europe. *Neuschel*
- 133. Medieval Europe, 300-1400. *Young*
- 134. Medieval England. *Young*
- 138. Early Modern Germany. *Robisheaux*
- 148. Introduction to Renaissance Studies. *Robisheaux, Schwartz, and staff*
- 173. History of Spain from Late Medieval Times to the Present. *TePaske*
- 174. History of Colonial Hispanic America from Pre-Columbian Times to the Wars of Independence. *TePaske*
- 195S.01-196S.01. Renaissance Intellectual History, 1300 to 1600. *Witt*
- 195S.13-196S.13. Problems in Early Modern English History. *Herrup*
- 195S.20. Comparative Problems in Early Modern European History. *Neuschel or Robisheaux*
- 195S.28. The Black Death and the Crisis of Late Medieval Europe. *Robisheaux*
- 207, 208. Constitutional History of Britain: The Rise of the Common Law. *Herrup*
- 222. Problems in the Intellectual History of the European Renaissance and Reformation. *Witt*
- 237S. Europe in the Early Middle Ages. *Young*
- 238S. Europe in the High Middle Ages. *Young*
- 267S. England in the Sixteenth Century. *Herrup*
- 268S. England in the Seventeenth Century. *Herrup*

## Interdisciplinary Courses

- 21S. Freshman Seminar: Topics in Medieval Studies. *Staff*
- 22S. Freshman Seminar: Topics in Renaissance Studies. *Staff*
- 114. Introduction to Medieval Studies. *Solterer, Witt, and staff*
- 115. Introduction to Renaissance Studies. *Robisheaux, Schwartz, and staff*
- 160S. Topics in Medieval and Renaissance Studies. *Staff*

## Italian

- 101. Writers of the Middle Ages and Quattrocento. *Caserta or Finucci*
- 102. Writers from the Renaissance to Pre-Romanticism. *Caserta or Finucci*
- 145S. Topics in Renaissance Literature and Culture. *Finucci*
- 284, 285. Dante. *Caserta*

## Latin

- 221. Medieval Latin. *Newton*

## Music

- 155S. Music History I: Antiquity, Middle Ages, Early Renaissance. *Higgins, Seebass, or Silbiger*
- 156S. Music History II: Late Renaissance, Baroque. *Bartlet, Higgins, Seebass, Silbiger, or Williams*
- 211. Notation. *Higgins or Williams*
- 222. Music in the Middle Ages. *Higgins or Seebass*
- 223. Music in the Renaissance. *Higgins or Silbiger*

## Philosophy

- 119. Medieval Philosophy. *Mahoney*
- 120. Late Medieval and Renaissance Philosophy. *Mahoney*
- 218S. Medieval Philosophy. *Mahoney*
- 219S. Late Medieval and Renaissance Philosophy. *Mahoney*

## Religion

- 134. Jewish Mysticism. *Bland*
- 162. Introduction to Islamic Civilization. *Lawrence and staff*

## Spanish

- 151. Spanish Literature of the Renaissance and the Baroque. *Ross or Wardropper*
- 153. Golden Age Literature: Cervantes. *Staff*
- 210. History of the Spanish Language. *Garcí-Gómez*
- 251. The Origins of Spanish Prose Fiction. *Wardropper*
- 254. Drama of the Golden Age. *Wardropper*
- 258S. Spanish Lyric Poetry before 1700. *Wardropper*

## THE MAJOR

A major consists of at least eight courses drawn from the nonintroductory courses of the four areas of study (fine arts, history, language and literature, and philosophy-religion). Three courses in each of two areas must be included. Besides the courses specifically listed (under departmental and Interdisciplinary Course headings) in the



Medieval and Renaissance periods, provision may be made for independent study in any of the four areas.

Each program is tailored to the needs and interests of the student under the supervision of a committee consisting of faculty members from appropriate departments. After discussion with the Director of Undergraduate Studies for Medieval and Renaissance Studies, the student submits a provisional program of study outlining special interdisciplinary interests. Normally the program is planned well before the end of the sophomore year to allow time to acquire a working knowledge of languages pertinent to specific interests.

## Microbiology and Immunology (MIC)

For courses in Microbiology and Immunology, see School of Medicine—Basic Courses Open to Undergraduates.

## Military Science—Army ROTC (MSC)

Professor Gibbs, Lieutenant Colonel, U.S. Army, *Chairman*; Visiting Assistant Professor Jones, Major, U.S. Army, *Director of Undergraduate Studies*; Visiting Assistant Professor Ralston, Captain, U.S. Army, *Supervisor of Freshman Instruction*; Visiting Assistant Professors Dillard, Captain, U.S. Army, Morris, Major, U.S. Army, and Petzrick, Captain, U.S. Army

The Department of Military Science offers students from all disciplines within the University the opportunity to learn the theory and practical application of skills involving the following areas: leadership, management (time, personnel, and materiel), communications, land navigation, military law, and tactics. Non-ROTC students may take courses without incurring an obligation to the Army.

The Army ROTC program is made up of a two-year basic course of study (freshman and sophomore level) which is taken without obligation by nonscholarship students, and a two-year advanced course of study (junior and senior level) which includes a six-week advanced camp, usually completed during the summer prior to the senior year. Direct entry into the advanced course is sometimes permitted if an applicant has previous military training or experience, or when a six-week basic camp is completed. To be eligible for participation in the advanced course, students must successfully complete the basic course (unless direct entry is permitted), be physically qualified, be of good moral character, have a minimum of two years remaining as a student (undergraduate or graduate level, or a combination), and sign a contract to accept a commission in the United States Army, the Army National Guard, or the Army Reserve as directed by the Secretary of the Army.

Laboratory is mandatory each semester for scholarship cadets and nonscholarship cadets in their second or later semester of ROTC. Some specific laboratories are required for non-ROTC students taking Military Science 51, 52, and 113. Students should consult the Department of Military Science (telephone 1-919-684-5895 collect, or 1-800-222-9184, toll free) for more detailed information. Also see the Army Reserve Officers' Training Corps section under Special Programs in this bulletin.

**1L. Fall Semester Laboratory.** Drill and ceremonies, marksmanship training, land navigation exercises, first aid, and confidence course training. Mandatory for Army ROTC scholarship cadets and nonscholarship cadets in their second or later semester of ROTC who are enrolled in Military Science 11, 51, 113, and 151. Must be repeated with each course. No credit. *Dillard*

**2L. Spring Semester Laboratory.** Drill and ceremonies, communications, and tactical exercises. Mandatory for Army ROTC scholarship cadets and nonscholarship cadets in their second or later semester of ROTC who are enrolled in Military Science 12, 52, 114, and 152. Must be repeated with each course. No credit. *Dillard*

**11. Introduction to ROTC and the Army.** The military organization with emphasis on tradition, doctrine, and contribution to national objectives. Laboratory required for ROTC scholarship cadets only. Half course. *Morris or Ralston*

**12. The Military Profession.** Introduction to the concept of the military as a profession. Questions of ethics and values in the military; the issue of war and morality. Laboratory required for ROTC cadets only. Half course. *Morris or Ralston*

**51. Military Topography.** Interpretation and use of topographical maps to facilitate land navigation. Consideration of the military significance of terrain. Laboratory required for Army ROTC cadets only, with minor exceptions. Half course. *Petrick*

**52. Introduction to Small Unit Tactics.** Introduction to planning, organizing, and conducting small unit offensive and defensive operations. Consideration of the principles of war. Laboratory required for Army ROTC cadets only, with minor exceptions. Half course. *Petrick*

**113. Advanced Military Operations.** Fundamentals of the conduct of military operations including advanced military topography; unit movements; route planning; nuclear, biological, and chemical defense; and military communications. Laboratory required for Army ROTC cadets only. Prerequisite: Military Science 51. One course. *Dillard or Gibbs*

**114. Advanced Tactical Applications.** Study of the Warsaw Pact Forces to include doctrine, organization, equipment, and training. Conduct of platoon offensive, defensive, and patrolling operations for Army infantry units. Laboratory required for Army ROTC cadets only. Prerequisite: Military Science 52. One course. *Dillard or Gibbs*

**151. Military Justice and the Law of War.** Introduction to the Uniform Code of Military Justice and its relationship to the American legal system. Theory and practice of the law of war as embodied in the Geneva, Hague, and other agreements. Laboratory required for Army ROTC cadets only. One course. *Gibbs or Jones*

**152. Leadership and Command Management.** Theory and practice of leadership and military management techniques for mission accomplishment. Laboratory required for Army ROTC cadets only. One course. *Gibbs or Jones*

**191. Independent Study.** Directed readings and research in military science. One course. *Gibbs or Jones*

## Music (MUS)

Professor Silbiger, *Chairman*; Artist-in-Residence Parkins, *Director of Undergraduate Studies*; Professor Williams; Associate Professors Jaffe, Seebass, and Todd; Assistant Professors Bartlet, Gilliam, Henry, Higgins, and Hill; Adjunct Assistant Professor Druessedow; Artists-in-Residence Coleman, Jeffrey, Love, Muti, Szász, Troxler, and Wynkoop; Artists-in-Residence (Institute of the Arts) Bagg, Berg, Bloom, and Raimi; Staff Associates Dimsdale, Gilmore, Hanks, Hawkins, Jensen, Ketch, Lail, Mizesko, Peck, Pederson, and Weddle

A major is available in this department.

For over two thousand years, music has been viewed as a crucial part of education, compulsory in some cultures, optional in many, formative in all. Music is customarily regarded as an art, but as a university subject it has its own scientific language, logic, and grammar, in the understanding of which the mind is stretched and tested. Furthermore, music as taught at Duke includes assumptions that history, theory, composition, and performance are areas of comparable worth both in themselves and as a means of understanding the many facets of musicianship. Almost every student has some personal involve-

ment with music (often with the many kinds of music), and the courses aim to further that involvement, whether passive or active, a simple hobby or compelling force.

Courses include many kinds of instruction: instrumental lessons, history and theory lectures, harmony classes, composition seminars, ensemble participation, practical laboratory work (such as ear-training), and coaching sessions for conductors. Emphasis is placed equally on theory and practice, and students' musical activity can vary widely across the spectrum from composing their own music to endeavoring to understand the technical, historical, and sociological context of other composers' music.

Musical studies can have a particular value in Program II. So many areas of interest in literature (English and world literature), the arts, art history, sociology, politics, philosophy, religion, psychology, and physics are illustrated, paralleled, or elucidated by aspects of music, just as music itself is by those other disciplines.

## **THEORY AND COMPOSITION**

The department's theory courses are designed to give the student a deeper understanding of musical materials: harmony, counterpoint, voice leading, and musicianship. This is accomplished through analysis of repertoire, composition, aural work, and keyboard playing (score reading, figured bass, and simple improvisation).

**36. Acoustics and Music. (NS)** No previous knowledge of physics is assumed. See C-L: Physics 36. One course. *Lawson*

**55. Introduction to Music Theory. (AL)** Fundamentals of notation, melodic and harmonic practice, analysis, and score reading, as a basis for independent work. Does not count for major requirements. Prerequisite: some ability to read music. One course. *Troxler or staff*

**65. Fundamentals of Music Theory. (AL)** Physical properties of sound, principles of diatonic tonal organization, melodic and harmonic constructions, elementary counterpoint, and figured bass. Laboratory. Prerequisite: basic knowledge of musical notation and vocabulary. One course. *Hill or Wynkoop*

**66. Tonal Harmony. (AL)** Harmonic language of eighteenth and nineteenth centuries, functional chromaticism, and introduction to musical forms. Laboratory. Prerequisite: Music 65. One course. *Hill or Wynkoop*

**67S. Composition I. (AL)** Composing original music in smaller forms for voice, piano, and other instruments. Studies in compositional techniques. Prerequisites: Music 65 and 66 or consent of instructor. One course. *Jaffe*

**68S. Composition II. (AL)** See Music 67S. Prerequisites: Music 65 and 66 or consent of instructor. One course. *Jaffe*

**75. Jazz Improvisation. (AL)** The theory of jazz improvisation for all instruments and its practical application to the different styles of jazz. Prerequisite: consent of instructor. Half course. *Jeffrey*

**115S. Modal Counterpoint. (AL)** Polyphonic practice of the fifteenth and sixteenth centuries; sacred and secular music. Laboratory. Prerequisite: Music 66 or consent of instructor. One course. *Higgins*

**116S. Tonal Counterpoint. (AL)** Polyphonic practice of the seventeenth, eighteenth, and nineteenth centuries; sacred and secular music. Laboratory. Prerequisite: Music 115S or consent of instructor. One course. *Higgins, Jaffe, or Williams*

**122. Orchestration. (AL)** Characteristics and transpositions of the instruments. Scoring for symphony orchestra; concert band; and string, woodwind, brass, and percussion ensembles from pre-existing piano scores or the student's original compositions. Prerequisite: Music 116S. One course. *Jaffe*



**128. Instrumental Conducting. (AL)** Development of techniques of conducting instrumental ensembles with emphasis on orchestral repertoire. Score-reading and analysis, principles of interpretation, and practical conducting experience. Prerequisite: Music 116S or consent of instructor. One course. *Muti*

**129. Choral Conducting. (AL)** Development of techniques of conducting vocal repertoire, ranging from church anthems to large-scale works. Score-reading and analysis, principles of interpretation, and practical conducting experience. Prerequisite: Music 116S or consent of instructor. One course. *Wynkoop*

## HISTORY, LITERATURE, AND MUSICOLOGY

The study of music history and literature contributes to a broader knowledge of culture and society. Courses offer students the opportunity to examine compositions in their historic and/or social context. In addition to surveying significant forms, genres, and styles, and their development, the courses include consideration of music's function, the place of musicians, aspects of performance practice, and aesthetic value. Although the normal prerequisite for Music 155S-158S (Music History I-IV) is Music 65, interested students in other disciplines with some background in music are encouraged to ask individual instructors for permission to enroll.

**49S. Freshman Seminar.** Topics vary each semester offered. One course. *Staff*

**74. Introduction to Jazz. (AL)** A survey examining musical, aesthetic, sociological, and historical aspects. For nonmajors. C-L: Afro-American Studies 74. One course. *Jeffrey*

**76. Introduction to the Symphony. (AL)** Selected works from the classical, romantic, impressionist, and contemporary periods that examine the creation, enjoyment, and evaluation of symphonic literature. Development of critical abilities through the study of style, structure, and orchestration in the symphony, concert suite, symphonic poem, and program symphony. For nonmajors. One course. *Henry*

**77. Introduction to Chamber Music. (AL)** A survey of major works of chamber music through live performances and discussions with participating artists. The role of chamber music in Western society and its portrayal in art and literature. With the participation of the Ciompi Quartet and visiting ensembles. For nonmajors. One course. *Silbiger*

**119. The Humanities and Music. (AL)** A historical survey of the relationship of significant literary texts to music, exemplifying literary genres and concepts with musical works from antiquity to the nineteenth century. Readings from primary literary sources, listening to representative musical settings. Does not count for the major in music. C-L: Comparative Area Studies. One course. *Bartlet, Higgins, or Seebass*

**120S. Women in Music. (CZ)** The lives and works of the principal women composers and musicians of Western art music from the Middle Ages to the present within their contemporary intellectual, artistic, sociological, and economic contexts. The extent to which gender as an historical variable affected their creative activities and achievements as well as the critical assessment of their canon. C-L: Women's Studies. One course. *Higgins*

**125. Masterworks of Music. (AL)** An introduction to the lives and works of major Western composers. For nonmajors. C-L: Comparative Area Studies. One course. *Druesedow, Henry, Muti, or Todd*

**125D. Masterworks of Music. (AL)** Same as Music 125 except instruction is provided in two lectures and one small discussion meeting each week. One course. *Gilliam and staff*

**135S. American Music to 1900. (AL)** Music from the settlement of the Pilgrims in 1620 to the early ragtime era (the 1890s). Hymnody, stage music, popular song, instrumental concert music, national tunes, and other genres. One course. *Druesedow*

**136S. Introduction to Non-Western Music. (AL)** Study of social and religious contexts. Native instruments and related craftsmanship. C-L: Comparative Area Studies. One course. *Seebass*

**138. Music in East and Southeast Asia. (AL)** An introduction to the musical culture of Japan, China, mainland Southeast Asia, Indonesia, and the Philippines. Notation, performance, and musical instruments; historical, religious, and social context. C-L: Comparative Area Studies. One course. *Seebass*

**139. Twentieth-Century Music. (AL)** Influential creative stylistic developments in music of the present century. A critical survey of works by Bartók, Berg, Schoenberg, Stravinsky, and Webern as a means of establishing a relative standard of values for subsequent independent exploration. Prerequisite: a one-year course in music theory or literature, or consent of instructor. One course. *Jaffe or Todd*

**143. Beethoven and His Time. (AL)** The music of Beethoven and its relation to contemporary historical, social, and literary developments. Emphasis on the nine symphonies. C-L: Comparative Area Studies. One course. *Bartlet, Gilliam, Silbiger, or Todd*

**144. Bach and His Time. (AL)** The music of Johann Sebastian Bach and its historical and cultural background, with emphasis on the sacred and the instrumental works. Some consideration also given to the music of Bach's contemporaries, including Vivaldi, Rameau, and Handel. C-L: Comparative Area Studies. One course. *Hill or Silbiger*

**145. Mozart and His Time. (AL)** A biographical sketch and a study of his works in their relationship to the past and to works of contemporaries in various European countries. C-L: Comparative Area Studies. One course. *Seebass*

**146. Mendelssohn and Schumann. (AL)** The music of Felix Mendelssohn-Bartholdy and Robert Schumann and its role in the evolution of German music in the nineteenth century. Topics include the Bach revival, the character piece, the art song, the concert overture, programmatic music, and music criticism. Prerequisite: consent of instructor. One course. *Todd*

**155S. Music History I: Antiquity, Middle Ages, Early Renaissance. (AL)** Prerequisite: for music majors, Music 65 or consent of instructor; for nonmajors, consent of instructor. C-L: Medieval and Renaissance Studies. One course. *Higgins, Seebass, or Silbiger*

**156S. Music History II: Late Renaissance, Baroque. (AL)** Prerequisite: for music majors, Music 65 or consent of instructor; for nonmajors, consent of instructor. C-L: Comparative Area Studies and Medieval and Renaissance Studies. One course. *Bartlet, Higgins, Seebass, Silbiger, or Williams*

**157S. Music History III: Rococo and Classic. (AL)** Prerequisite: for music majors, Music 65 or consent of instructor; for nonmajors, consent of instructor. C-L: Comparative Area Studies. One course. *Bartlet, Seebass, Silbiger, or Todd*

**158S. Music History IV: Romanticism to the Early Modern Period. (AL)** Prerequisite: for music majors, Music 65 or consent of instructor; for nonmajors, consent of instructor. C-L: Comparative Area Studies. One course. *Bartlet, Gilliam, Silbiger, or Todd*

**161. Musicianship I.** Development of practical musical skills: sight singing, ear training, and keyboard proficiency. Normally taken concurrently with Music 115S. Prerequisite: for music majors, Music 66; for nonmajors, consent of instructor. Quarter course. *Staff*

**162. Musicianship II.** Prerequisite: Music 161. Quarter course. *Staff*

**163. Musicianship III.** Prerequisite: Music 162. Quarter course. *Staff*

**164. Musicianship IV.** Prerequisite: Music 163. Quarter course. *Staff*

**166. Opera. (AL)** History of opera from the late sixteenth century to the present. Relationship of music and text; opera as social commentary; changing forms and styles. Selected composers, especially Mozart, Verdi, Puccini, and Wagner. One course. *Bartlet or Muti*

**171S. Bach: Master of Style. (AL)** See C-L: Distinguished Professor Course 194S. One course. *Williams*

**185S, 186S. Seminar in Music. (AL)** Primarily for junior and senior music majors. Topics to be announced. Prerequisite: consent of instructor. One course each. *Staff*

### For Advanced Undergraduates and Graduates

**201. Introduction to Musicology. (AL)** Methods of research on music and its history, including studies of musical and literary sources, iconography, performance practice, ethnomusicology, and historical analysis, with special attention to the interrelationships of these approaches. One course. *Druesedow or Seebass*

**203. Proseminar in Performance Practice. (AL)** Critical methods in the study of historical performance practice, including the evaluation of evidence provided by musical and theoretical sources, archival and iconographic materials, instruments, and sound recordings. Current issues regarding the performance practice for music from the middle ages to the twentieth century. One course. *Silbiger*

**211, 212. Notation. (AL)** Development and changing function of musical notation from c. 900 to c. 1900, including plainchant notations, black notations, white notations, the invention of printing (particularly movable type and engraving), keyboard and lute tablatures, scores. One course each. *Higgins or Williams*

**213. Theories and Notation of Contemporary Music. (AL)** The diverse languages of contemporary music and their roots in the early twentieth century, with emphasis on problems and continuity of musical language. Recent composers and their stylistic progenitors: for example, Ligeti, Bartók, and Berg; Carter, Schoenberg, Ives, and Copland; Crumb, Messiaen, and Webern; Cage, Varèse, Cowell, and Stockhausen. One course. *Jaffe*

**215. Music Analysis. (AL)** Historical, philosophical, and ideological issues raised by music analysis. Intensive study of harmony and voice leading in the works of major tonal composers, with emphasis on the analytic approach of Heinrich Schenker. One course. *Hill or Todd*

**222. Music in the Middle Ages. (AL)** Selected topics. C-L: Medieval and Renaissance Studies. One course. *Higgins or Seebass*

**223. Music in the Renaissance. (AL)** Selected topics. C-L: Medieval and Renaissance Studies. One course. *Higgins or Silbiger*

**224. Music in the Baroque Era. (AL)** Selected topics. One course. *Hill, Silbiger, or Williams*

**225. Music in the Classic Era. (AL)** Selected topics. One course. *Bartlet, Seebass, or Todd*

**226. Music in the Nineteenth Century. (AL)** Selected topics. One course. *Bartlet, Gilliam, or Todd*

**227. Music in the Twentieth Century. (AL)** Selected topics. One course. *Gilliam or Todd*

**236. Nineteenth-Century Piano Music. (AL)** Beethoven, Schubert, Weber, Mendelssohn, Schumann, Chopin, Liszt, and Brahms. The arts of improvisation and transcription, the keyboard virtuoso, the character piece, and the conflict between romantic content and form. One course. *Todd*



**295S. Composition Seminar. (AL)** Selected topics in composition, including original composition in stylized genres (for example, Classical-period sonata, Romantic piano piece, free atonal song) as well as free composition on given materials. Related topics in form, harmony, and instrumentation. One course. *Jaffe*

**296S. Analysis of Contemporary Music. (AL)** Structures, expressive intentions, and functions since 1914. Contemporary orchestral music, American music, European music, popular media, musical tradition and contemporary composers. Analysis of works performed in the department's Encounters Series with occasional guest composers present. One course. *Jaffe*

**297, 298, 299. Composition. (AL)** Weekly independent study sessions at an advanced level with a member of the graduate faculty in composition. One course each. *Jaffe*

## INDEPENDENT STUDY AND SEMINARS

Admission to these courses will be subject to the approval of the Director of Undergraduate Studies and the instructor. The instructor and course content will be established in accordance with the individual student's interests and capacities.

**179, 180. Independent Study in Musical Performance.\*** Open only to sophomores possessing an exceptional technical and interpretative command of a musical medium. Requires either a half-length recital at the end of each semester of study or a full-length recital at the end of the second semester. In the latter case, a brief performance before a jury of music department faculty is required at the end of the first semester. Prerequisites: previous registration in private instruction in applied music at Duke, audition, and consent of instructor. One course each. *Staff*

**181, 182. Independent Study in Musical Performance.\*** Same as 179, 180, but for juniors. One course each. *Staff*

**183, 184. Independent Study in Musical Performance.\*** Same as 179, 180, but for seniors. One course each. *Staff*

**191, 192. Independent Study.** Directed reading, research, and/or theoretical analysis, culminating in a substantial paper; or exploration of advanced compositional techniques resulting in a work of larger scale. One course each. *Staff*

**193, 194. Independent Study.** Same as 191, 192, but for seniors. One course each. *Staff*

## APPLIED MUSIC

In conjunction with theory and history, performance is an active way of understanding music literature, facing questions of style, and honoring one's technical and expressive skills. Provided they qualify by audition, students are encouraged to enroll in private instruction and to participate in ensembles. Auditions must be arranged with the instructor prior to registration. For those students who wish to study privately but do not qualify for university-level instruction, a list of music teachers in the immediate area who are available to Duke students can be obtained from the department office. All applied music courses may be repeated for credit, but no more than two ensembles may be taken concurrently for credit.

**57S, 58S. Vocal Diction.** 57S: Italian/English; 58S: German/French. For singers, actors, radio announcers, and public speakers. Introduction to the international phonetic alphabet. Students will be required to sing in class. Written, oral, and vocal performance examinations. Half course each. *Lail or Peck*

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\*The schedule of fees for private lessons, as published in the subsection on fees, is applicable to courses 179, 180, 181, 182, 183, 184.

**Instruction: half hour**

- 78. **Class Harpsichord.** Quarter course. *Hill*
- 79. **Class Voice.** Quarter course. *Lail*
- 80. **Piano.** Quarter course. *Coleman, Hawkins, Love, or Szász*
- 81. **Strings.** Quarter course. *Bagg, Berg, Bloom, or Rainii*
- 82. **Woodwinds.** Quarter course. *Gilmore, Jeffrey, Pederson, Troxler, or Weddle*
- 83. **Brass.** Quarter course. *Dimsdale, Ketch, or Mizesko*
- 84. **Percussion.** Quarter course. *Hanks*
- 85. **Voice.** Quarter course. *Jensen, Lail, or Peck*
- 86. **Organ.** Quarter course. *Parkins*
- 87. **Harpsichord.** Quarter course. *Hill*

**Instruction: 1 hour**

- 90. **Piano.** Half course. *Coleman, Hawkins, Love, or Szász*
- 91. **Strings.** Half course. *Bagg, Berg, Bloom, or Rainii*
- 92. **Woodwinds.** Half course. *Gilmore, Jeffrey, Pederson, Troxler, or Weddle*
- 93. **Brass.** Half course. *Dimsdale, Ketch, or Mizesko*
- 94. **Percussion.** Half course. *Hanks*
- 95. **Voice.** Half course. *Jensen, Lail, or Peck*
- 96. **Organ.** Half course. *Parkins*
- 97. **Harpsichord.** Half course. *Hill*

**Ensemble Classes: pass/fail**

- 100. **Symphony Orchestra.** Quarter course. *Muti*
- 101. **Wind Symphony.** Quarter course. *Staff*
- 102. **Marching Band.** Quarter course. *Boumpani*
- 103. **Jazz Ensemble.** Quarter course. *Jeffrey*
- 106. **Chamber Music.** Quarter course. *Hawkins*
- 110. **Collegium Musicum.** Quarter course. *Hill*
- 111. **Opera Workshop.** Quarter course. *Staff*
- 112. **Chapel Choir.** Quarter course. *Staff*
- 113. **Chorale.** Quarter course. *Wynkoop*

**Credit in Applied Music.** (Skills courses—credit not applicable to distributional requirements.)\* Credit for instruction in courses below 100 is granted on the basis of a half course per semester for one hour of private instruction per week and a minimum of six hours practice weekly; or a half course per year for one half hour of private instruction or one period of class study and a minimum of six hours practice per week. An additional weekly class meeting for performance and criticism may be required by the instructor without additional credit.

**Fees.** Applied music instruction in one medium (instrument or voice) is offered free to music majors. Additional instruction for music majors and all instruction for nonmajors will be charged as follows:

One half-hour private lesson per week for one semester	\$100
One one-hour private lesson per week for one semester	\$200
One half-hour class lesson per week for one semester	\$60
Registration in ensemble classes (Music 100-113)	Free

No charge is made for practice room facilities for students registered for private or class lessons in applied music. A fee schedule for the use of facilities by others not registered for applied lessons is available from the music department office.

**Fees are not refundable after the final drop/add day.**

*See also Institute of the Arts in this bulletin.*

## **COURSES CURRENTLY UNSCHEDULED**

### **130T, 131T. Performance Practice (Organ) I, II. (AL)**

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\*Subject to instructor's approval, a student at an advanced level in applied music may take courses for tutorial requirements. These courses shall be designated by adding a *T* to the appropriate course number. Students who have not reached an advanced level will continue to take the regular applied music courses.

132T, 133T. **Performance Practice (Organ) III, IV. (AL)**

137. **Music in South Asia. (AL)**

142. **The Musical Theater. (AL)**

160. **History of the Organ and Its Literature. (AL)**

170. **Romanticism in the Arts. (AL)**

## THE MAJOR

A major or second major in music is a means of preparing students for further professional training in the branches of the art, for graduate study as historians, composers, and performers, and for a more intimate understanding of one of life's most important experiences.

The aim of the required courses is to give a balanced selection of history, theory, composition, and performance, reinforced by constant attention to the art of listening. With the required courses as their foundation, students choose electives to further their interest in, or gifts for, a particular music activity, so that a performer will have a good theoretical background, a historian considerable experience as a player, a composer various kinds of understanding of music of the past, and so on.

*Prerequisites.* Music 65, 66, and one year of applied music study in an instrument or voice; two semesters of participation in a departmental ensemble (excluding Music 102 and 112), with or without credit.

*Major Requirements.* Music 115S, 116S, 155S-158S, 161-164 (one course), and one additional elective course in the department. Those who plan to study music beyond the undergraduate level are strongly advised to prepare themselves in two or more foreign languages.

*Honors.* Music majors who are qualified (see the section on honors in this bulletin) may undertake work leading to departmental graduation with distinction or Latin honors by honors project. In either case the candidate must make application to the Director of Undergraduate Studies by March 20 of the junior year. The project is normally a year-long endeavor involving an independent study or an appropriate graduate seminar each semester of the senior year. It must culminate in a substantial paper (historical, analytical, or theoretical), which may be more concise if offered in conjunction with a recital or a composition. The final project must be approved by a faculty committee.

## Naval Science—Navy ROTC (NS)

Professor Triebel, Captain, U.S. Navy, *Chairman*; Visiting Associate Professor Meldrum, Commander, U.S. Navy, *Director of Undergraduate Studies*; Visiting Assistant Professors Dossett, Major, U.S. Marine Corps, Perry, Lieutenant, U.S. Navy, Uphoff, Lieutenant, U.S. Navy, and Greer, Lieutenant, U.S. Navy

Courses in naval science are open to all students. The program in naval science offers students an opportunity to gain a broad-based knowledge in naval studies leading to a challenging career as a naval or marine corps officer.

Since a major is not available in this program, scholarship program participants are encouraged to pursue majors in technical fields, although a major in any field of study leading to a baccalaureate degree meets the basic requirement. The academic program for an approved degree and commission must include all naval science courses and laboratories. Navy option scholarship students must complete one year of calculus by the end of the sophomore year, one year of calculus-based physics by the end of the junior year, one year of American military history or national security policy, one year of English, one semester of an Indo-European or Asiatic language, and one semester of computer science.

Nonscholarship Navy option student requirements are one year of mathematics, one year of physical science, one year of English, and one semester of computer science.



Marine Corps option students are required to take one year of American military history or national security policy and, if on scholarship, one semester of a foreign language.

**11. Naval Orientation.** The missions, warfare communities, and organization of the United States Navy. Seapower, the maritime strategy, the Soviet Navy, leadership, the Uniform Code of Military Justice, and naval customs. No credit. *Greer*

**11L. Naval Orientation Laboratory.** Practical application of the elements and material presented in Naval Science 11. No credit. *Greer*

**12. Naval Ships Systems.** Structure, elements of design, stability, compartmentation, communications, and propulsion systems as they bear on safe operation and combat or service effectiveness. One course. *Greer*

**12L. Naval Ships Systems Laboratory.** Practical application of the theories and principles of naval ships systems. No credit. *Greer*

**52. Seapower and Maritime Affairs.** The role of seapower in national and foreign policy, and as an instrument of politico-military strategy. Includes comparative study of United States and Soviet maritime strategies. One course. *Triebel*

**53L. Seapower Laboratory.** Case studies and contemporary issues dealing with United States Navy. Mandatory for Navy ROTC midshipmen. No credit. *Triebel*

**126. Concepts and Analyses of Naval Tactical Systems.** Detection systems; systems integration into current naval platforms and their offensive and defensive capabilities. One course. *Perry*

**126L. Naval Tactical Systems Laboratory.** Practical application of the theories and principles of naval tactical systems. No credit. *Perry*

**131. Navigation.** Theory, principles, and procedures of ship navigation, movements, and employment. Dead reckoning, piloting, celestial and electronic principles of navigation. Naval Science 131L should be taken concurrently. One course. *Uphoff*

**131L. Navigation Laboratory.** Practical application of the theories and principles of navigation as presented in the lecture series. No credit. *Uphoff*

**132. Naval Operations.** Components of general naval operations, including concepts and application of tactical formations and dispositions, relative motion, maneuvering board and tactical plots, rules of the road, and naval communications. Naval Science 132L is a concurrent requirement. One course. *Uphoff*

**132L. Naval Operations Laboratory.** Practical application of the theories of naval operations as presented in the lecture series. No credit. *Uphoff*

**137L, 138L. Marine Tactics Laboratory.** Concepts and applications of tactical employment of Marine Amphibious Forces. Ground weapons systems, land navigation, and small unit tactics. No credit. *Dossett*

**141S. Evolution of Warfare.** Continuity and change in the history of warfare, with attention to the interrelationship of social, political, technological, and military factors. One course. *Dossett*

**145L. Naval Leadership and Management I.** Study of organizational behavior and management in the context of naval organization. Topics include discussion of leadership and management functions of planning, controlling, and directing. Practical applications explored using case studies. No credit. *Meldrum*

**146L. Naval Leadership and Management II.** The study of officer responsibilities in Naval administration. Discussions of counseling methods, military justice, human resources management, and supply systems. No credit. *Meldrum*

**147L, 148L. Marine Leadership Laboratory.** Marine Corps career management, naval correspondence, force structure, leadership techniques, and training. No credit. *Dossett*

**151S. Amphibious Operations.** Development of amphibious doctrine, with attention to its current applications. One course. *Dossett*

**191. Independent Study.** Directed reading and research. Open only to qualified students in junior and senior years by consent of Director of Undergraduate Studies. One course. *Staff*

## Neurosciences Program

Professor Staddon, *Director*

A certificate, but not a major, is available in this program.

The study of the nervous system has developed into one of the most exciting areas of modern science with rapidly expanding knowledge in both basic and medically applied areas. This program offers the student a liberal arts education with the opportunity to emphasize studies in the neural sciences. The neurosciences certificate program is also excellent preparation for graduate study or professional school.

Acceptance into the biology-psychology interdepartmental concentration is by arrangement with the Directors of Undergraduate Studies in biology and psychology. The interdepartmental concentration, which fulfills the requirements of a major for graduation, requires four courses beyond the introductory level in biology and three in psychology. Beyond this, acceptance into the neurosciences program is limited by the size of the core neurosciences courses.

The required *core* courses are Psychology 103 and Interdisciplinary Courses 200 and 201. A selection from a number of recommended *allied* courses allows students to select particular areas of neuroscience and related fields. Independent study and research with the various faculty are encouraged. A strong background in the sciences is required.

A certificate in the neurosciences may be awarded at graduation upon successful completion of the course of study and approval of the advisory committee and Directors of Undergraduate Studies in biology and psychology.

### Core Courses

**Psychology 103. Biological Bases of Behavior.** Physiological, developmental, and evolutionary approaches to behavior. Sensory and cognitive processes, sleep, pain, emotion, hunger, and thirst as well as maternal and sexual behavior patterns. Prerequisite: Biology 14L or 21L; may be taken concurrently. One course. *C. Erickson*

**Interdisciplinary Course 200. Advanced Neuroscience I.** Basic neuroanatomy and neurophysiology, physiology of the neuron and neural networks, neurotransmitter functions, sensory and motor systems. Prerequisite: Psychology 103. C-L: Biology 200 and Psychology 200. One course. *Cant and McClay*

**Interdisciplinary Course 201. Advanced Neuroscience II.** Integrative activities of the nervous system; sensory-motor relationships, neuroendocrine relationships, emotion and motivation, sleep, learning and memory, diseases of the nervous system and their psychological correlates. Prerequisite: Biology 200, Interdisciplinary Course 200, or Psychology 200. C-L: Psychology 201. One course. *R. Erickson and W. G. Hall*

Further details on the neurosciences program may be obtained from the Office of the Director (Professor Staddon), 249 Sociology-Psychology Building.

## Philosophy (PHL)

Professor Sanford, *Chairman*; Professor Mahoney, *Director of Undergraduate Studies*; Professor Golding; Associate Professors Brandon and Posy; Assistant Professors Ferejohn, Lind, Roderick and Vander Waerdt; Professors Emeriti Peach and Welsh; Adjunct Associate Professor Ward; Visiting Professor Van Cleve

A major is available in this department.

The undergraduate program in the Department of Philosophy acquaints students with the content and the structure of philosophical theory in various areas. Discussion is encouraged so that students can engage actively in the philosophical examination of problems.

Course offerings fall into two general categories: the systematic and the historical. In a systematic treatment, the organization of a course is primarily in terms of the problems presented by the subject matter of that course, as in logic, ethics, and metaphysics. In historical courses, attention is directed more to the order of development in the thought of a particular philosopher (Plato, Aristotle, Kant) or in a historical period. In all courses, reading of the works of philosophers acquaints the students with the important and influential contributions to the definition and solution of philosophical issues.

The problems raised in philosophy in respect to the various fields of the arts and sciences involve questions which are not normally given attention in those particular disciplines. In the consideration of such problems, therefore, it is expected that students will acquire some understanding and perspective of the major areas of the human intellectual endeavor. In this sense, philosophical comprehension is an essential part of a student's learning and education.

Philosophy provides a sound preparation for the demands of many professions. For example, the precision of argument and broad acquaintance with intellectual traditions emphasized in philosophy form an excellent basis for the study of law.

Only *one* course from among Philosophy 41, 42, 43S, and 44S may be taken for credit. These courses are normally not open to juniors and seniors.

**41. Introduction to Philosophy. (CZ)** Examination of problems in philosophy; emphasis on metaphysics and theory of knowledge. One course. *Staff*

**42. Introduction to Philosophy. (CZ)** Examination of problems in philosophy; emphasis on ethics and value theory. One course. *Staff*

**43S. Introduction to Philosophy. (CZ)** Philosophy 41 conducted as a seminar. One course. *Staff*

**44S. Introduction to Philosophy. (CZ)** Philosophy 42 conducted as a seminar. One course. *Staff*

**48. Logic. (CZ)** The conditions of effective thinking and clear communication. Examination of the basic principles of deductive reasoning. One course. *Brandon, Posy, Sanford, or Welsh*

**49S. Freshman Seminar.** Topics vary each semester offered. One course. *Staff*

**93. History of Ancient Philosophy. (CZ)** The pre-Socratics, Socrates, Plato, Aristotle, and post-Aristotelian systems. Prerequisites: for freshmen, previous philosophy course and consent of instructor. C-L: Classical Studies 93. One course. *Ferejohn, Mahoney, or Vander Waerdt*

**94. History of Modern Philosophy. (CZ)** Bacon, Hobbes, Descartes, Spinoza, Leibniz, Locke, Berkeley, Hume, and Kant. Prerequisites: for freshmen, previous philosophy course and consent of instructor. One course. *Posy or Van Cleve*

**102. Aesthetics: The Philosophy of Art. (CZ)** The concept of beauty, the work of art, the function of art, art and society, the analysis of a work of art, criticism in the arts. One course. *Ward*

**103. Symbolic Logic. (CZ)** Detailed analysis of deduction and of deductive systems. Open to sophomores by consent of instructor. C-L: Linguistics. One course. *Brandon or Posy*

**104. Philosophy of Science. (CZ)** The principal philosophical and methodological problems in contemporary science. One course. *Brandon*



**106. Philosophy of Law. (CZ)** Natural law theory, legal positivism, legal realism, the relation of law and morality. One course. *Golding*

**107. Political and Social Philosophy. (CZ)** The fundamental principles of political and social organizations. One course. *Mahoney*

**109. Philosophy of Language. (CZ)** A philosophical analysis of problems arising in the study of language and symbolism. Topics include: theories of language, the nature of signs and symbols, theories of meaning, types of discourse (scientific, mathematical, poetic), definition, ambiguity, metaphor. C-L: Linguistics. One course. *Posy*

**110. Knowledge and Certainty. (CZ)** Problems in the theory of knowledge: conditions of knowledge, scepticism, perception, memory, induction, knowledge of other minds, and knowledge of necessary truths. One course. *Sanford*

**111. Appearance and Reality. (CZ)** Problems in metaphysics: theories of existence, substance, universals, identity, space, time, causality, determinism and action, and the relation of mind and body. One course. *Ferejohn or Sanford*

**112. Philosophy of Mind. (CZ)** Such topics as mind and body, thought, perception, persons, and personal identity. One course. *Sanford*

**113. Philosophy of Mathematics. (CZ)** Survey of mathematical thought including the nature of infinity, Platonism, constructivism, and the foundational crisis of the early twentieth century. Prerequisite: one course in calculus or logic or philosophy; or consent of instructor. One course. *Posy*

**114D. Hellenistic Philosophy. (CZ)** The major epistemological and ethical controversies between the Epicureans, Stoics, and Academic skeptics. Topics include pleasure as our chief good, skepticism as the only intellectual stance that leads to happiness, and the criteria of infallible knowledge. Prerequisite: sophomore standing; Philosophy 93 suggested. C-L: Classical Studies 114D. One course. *Vander Waerdt*

**116. Systematic Ethics. (CZ)** Problems in moral philosophy: the nature of morality, ethical relativism, egoism, utilitarianism. Both historical and contemporary readings, with emphasis on the latter. One course. *Golding or Lind*

**117. Ancient and Modern Ethical Theories. (CZ)** The development of ethical thought in the West; the interaction between culture and ethical theory, with special reference to the Greek city-state, Roman law, the Renaissance, the Reformation, and the rise of modern science. Readings in the great ethical philosophers. One course. *Golding, Lind, or Welsh*

**118. Philosophical Issues in Medical Ethics. (CZ)** Ethical issues arising in connection with medical practice and research and medical technology. Definition of health and illness; experimentation and consent; genetic counseling and biological engineering; abortion, contraception, and sterilization; death and dying; codes of professional conduct; and the allocation of scarce medical resources. Prerequisites: for freshmen, previous philosophy course and consent of instructor. One course. *Brandon or Golding*

**119. Medieval Philosophy. (CZ)** Christian, Islamic, and Jewish philosophy from late antiquity to 1300. Special emphasis on historical influences and institutional developments. Nature and destiny of humans, existence and nature of God, problem of ethical norms, political philosophy. C-L: Medieval and Renaissance Studies. One course. *Mahoney*

**120. Late Medieval and Renaissance Philosophy. (CZ)** Problems of political authority and nature of the state, mysticism, humanism, critical trends, background of Galileo, and impact of the Reformation related to cultural and institutional changes. C-L: Medieval and Renaissance Studies. One course. *Mahoney*

**122. Philosophical Issues in Feminism. (CZ)** Issues in political and moral philosophy in their bearing on feminist concerns, including political equality and rights, preferential treatment, feminist and non-feminist critiques of pornography, and the morality of abortion. C-L: Women's Studies. One course. *Lind*

**125. Philosophy of Music. (CZ)** The nature of music and its place in the arts. Emotion and meaning, creation and interpretation in music. Readings from a wide variety of sources. One course. *Ward*

**132. Nineteenth-Century Philosophy. (CZ)** Emphasis on Hegel, Marx, and Nietzsche. One course. *Roderick*

**134. Existentialism. (CZ)** Themes and approaches in existential philosophy. Selected writings of Kierkegaard, Tolstoy, Dostoevsky, Heidegger, and Sartre. Contemporary relevance of existentialist perspectives. One course. *Ward*

**135. Philosophy in Literature. (CZ)** Comparative examination of philosophical topics such as freedom, responsibility, good and evil, time and reality. One course. *Staff*

**138. Analytic Philosophy in the Twentieth Century. (CZ)** An historical survey from Frege, Moore, Russell, and the logical positivism of the Vienna Circle to current developments. Philosophers covered include Wittgenstein, Ryle, Austin, Quine, and Davidson. Prerequisite: one philosophy course or consent of instructor. One course. *Posy or Sanford*

**139. Twentieth-Century Continental Philosophy. (CZ)** A critical and historical examination of movements in European philosophy such as existentialism, structuralism, post-structuralism, hermeneutics, and critical theory. Husserl, Heidegger, Sartre, Gadamer, Habermas, and Derrida: their views of language, history, and the problems of modern society. One course. *Roderick*

**173. Classical Political Philosophy. (CZ)** Prerequisite: junior standing; open to sophomores by consent of instructor. See C-L: Classical Studies 173. One course. *Vander Waerdt*

**191, 192, 193, 194. Independent Study.** Directed reading and research. Open only to highly qualified students in the junior and senior year with consent of the department. One course each. *Staff*

### For Seniors and Graduates

**203S. Contemporary Ethical Theories. (CZ)** The nature and justification of basic ethical concepts in the light of the chief ethical theories of twentieth-century British and American philosophers. One course. *Golding or Lind*

**204S. Philosophy of Law. (CZ)** Natural law theory and positivism; the idea of obligation (legal, political, social, moral); and the relation of law and morality. One course. *Golding*

**206S. Responsibility. (CZ)** The relationship between responsibility in the law and moral blameworthiness; excuses and defenses; the roles of such concepts as act, intention, motive, ignorance, and causation. One course. *Golding or Lind*

**208S. Political Values. (CZ)** Analysis of the systematic justification of political principles and the political values in the administration of law. One course. *Golding*

**211S. Plato. (CZ)** Selected dialogues. C-L: Classical Studies 211S. One course. *Ferejohn*

**217S. Aristotle. (CZ)** Selected topics. C-L: Classical Studies 217S. One course. *Ferejohn*

**218S. Medieval Philosophy. (CZ)** Selected problems. C-L: Medieval and Renaissance Studies. One course. *Mahoney*

**219S. Late Medieval and Renaissance Philosophy. (CZ)** Selected problems. C-L: Medieval and Renaissance Studies. One course. *Mahoney*

**225S. British Empiricism. (CZ)** A critical study of the writings of Locke, Berkeley, or Hume with special emphasis on problems in the theory of knowledge. One course. *Lind*

**227S. Continental Rationalism. (CZ)** A critical study of the writings of Descartes, Spinoza, or Leibniz with special emphasis on problems in the theory of knowledge and metaphysics. One course. *Van Cleave*

**228S. Recent and Contemporary Philosophy. (CZ)** A critical study of some contemporary movements, with special emphasis on analytic philosophers. One course. *Posy*

**231S. Kant's Critique of Pure Reason. (CZ)** One course. *Posy*

**232S. Recent Continental Philosophy.** Selected topics. One course. *Staff*

**233S. Methodology of the Empirical Sciences. (CZ)** Recent philosophical discussion of the concept of a scientific explanation, the nature of laws, theory and observation, probability and induction, and other topics. Prerequisite: consent of instructor. One course. *Brandon*

**234S. Problems in the Philosophy of Biology. (NS)** Selected topics, with emphasis on evolutionary biology: the structure of evolutionary theory, adaptation, teleological or teleonomic explanations in biology, reductionism and organicism, the units of selection, and sociobiology. Prerequisite: consent of instructor. C-L: Biology 234S. One course. *Brandon*

**235S. Nineteenth-Century German Philosophy. (CZ)** A critical examination of the writings of Hegel, Marx, or Nietzsche. One course. *Roderick*

**250S. Topics in Formal Philosophy. (CZ)** Topics selected from formal logic, philosophy of mathematics, philosophy of logic, or philosophy of language. One course. *Posy*

**251S. Epistemology. (CZ)** Selected topics in the theory of knowledge, for example, conditions of knowledge, scepticism and certainty, perception, memory, knowledge of other minds, and knowledge of necessary truths. One course. *Sanford*

**252S. Metaphysics. (CZ)** Selected topics: substance, qualities and universals, identity, space, time, causation, and determinism. One course. *Sanford*

**291S, 292S. Special Fields of Philosophy.** One course each. *Staff*

## COURSES CURRENTLY UNSCHEDULED

101. Philosophy of Religion. (CZ)

105. Philosophy of History. (CZ)

108. Social Ideals and Utopias. (CZ)

121. Philosophy and Film. (CZ)

196S, 197S, 198S, 199S. Seminars in Philosophy

202S. Aesthetics: The Philosophy of Art. (CZ)

205S. Philosophy of History. (CZ)

230S. The Meaning of Religious Language. (CZ)

253S. Philosophy of Mind. (CZ)

254S. Topics in Philosophy of Religion. (CZ)

## THE MAJOR

*Major Requirements.* Eight courses in philosophy including Philosophy 93 and 94; at least one nonintroductory course in moral, social, political, or legal philosophy, such as



Philosophy 106, 107, 108, 116, 117, 118, or 122; and at least one course at the 200 level. In addition, a course in logic is highly recommended.

*Honors.* The department offers work leading to graduation with distinction. See the section on honors in this bulletin.

## Physics (PHY)

Professor Evans, *Chairman*; Professor Walter, *Director of Undergraduate Studies*; Professors Biedenharn, Bilpuch, De Lucia, Fortney, Goshaw, Han, Herbst, Johnson, Madey, Meyer, Roberson, Robinson, Walker, and Weller; Associate Professors Behringer, Greenside, Palmer, and Thomas; Assistant Professors Howell, Oh, and Teitsworth; Research Associate Professor Tornow; Research Assistant Professor Benson; Visiting Assistant Professors Bittner and Holmgren; Instructor Haque; Instructor and Research Associates Brown, Hanly, and Schramm

A major is available in this department.

By studying physics students learn the methods and results of a systematic examination of the objects that make up the natural universe and of their interactions with each other. The knowledge and analytical skills thus obtained are basic to the study of the sciences and engineering. The department offers a number of courses for nonspecialists who wish to learn about the physicist's description of nature for its intrinsic intellectual value.

**21, 22. Introductory Physics.** These numbers represent course credit for advanced placement on the basis of the College Board Examinations "Physics-C." One course each.

**32. Physics from the Historical Perspective. (NS)** The historical development of physical theories is traced from early theories of the solar system to relativity and quantum theory. No previous study of physics is assumed, but the student must be able to use simple mathematics through basic algebra. One course. *Palmer or Walker*

**35. Practical Physics. (NS)** Fundamental concepts and laws of physics in the context of technological applications. Intended for persons not majoring in science or engineering; no previous knowledge of physics is assumed. The emphasis is on "how things work." One course. *Robinson*

**36. Acoustics and Music. (NS)** The physical principles underlying musical instruments, room acoustics, and the human ear. Analysis, reproduction, and synthesis of musical sounds. No previous knowledge of physics is assumed. C-L: Music 36. One course. *Lawson*

**41, 42. Fundamentals of Physics. (NS)** For students interested in majoring in physics; taken in the freshman year. Basic principles of physics, mainly classical, at a level similar to Physics 51, 52, but with emphasis on laying a foundation for further study. Lecture, recitations, and laboratory. Closed to students having credit for Physics 51, 52. Prerequisites: consent of Director of Undergraduate Studies; Mathematics 31 and 32 may be taken concurrently. One course each. *Evans or Palmer*

**51, 52. General Physics. (NS)** Basic principles of general physics treated quantitatively. Designed for students entering medicine, engineering, and the sciences. Not open for credit to students who have completed Physics 41, 42. Students planning to major in physics should enroll in Physics 41, 42 in their freshman year. Prerequisites: Mathematics 31 and 32 or equivalents; Mathematics 32 may be taken concurrently with Physics 51. One course each. *Staff*

**55. Introduction to Astronomy. (NS)** The evolving theory of the physical universe. Cosmological models, galaxies, stars, interstellar matter, the solar system, and experimental techniques and results. Several observatory sessions. One course. *Herbst or Kolena*

**100. Introduction to Modern Physics. (NS)** Survey of modern physics including relativity and the quantum physics of atoms, nuclei, particles, and quarks. Not applicable toward a major in physics. Prerequisites: Physics 51, 52 or 41, 42 and Mathematics 103 (may be taken concurrently). One course. *Hau*

**105. Introduction to Astrophysics. (NS)** Basic principles of astronomy treated quantitatively. Cosmological models, galaxies, stars, interstellar matter, the solar system, and experimental techniques and results. Prerequisites: Mathematics 31 and Physics 51, 52 or consent of the instructor. One course. *Kolena*

**143. Optics and Modern Physics. (NS)** Intended as a continuation of Physics 41, 42. Classical wave and ray optics. Special relativity. Introduction to quantum physics. Prerequisites: Physics 41, 42 or 51, 52 and Mathematics 103 (may be taken concurrently). One course. *Walter*

*Physics 41, 42 or 51, 52 or equivalents, and Mathematics 103 or equivalent are prerequisites to all of the following courses.*

**171. Electronics. (NS)** Elements of electronics including circuits, transfer functions, solid-state devices, transistor circuits, operational amplifier applications, digital circuits, and computer interfaces. Lectures and laboratory. One course. *Fortney*

**176. Thermodynamics and Kinetic Theory. (NS)** Thermodynamics, kinetic theory, and elementary statistical mechanics. One course. *Behringer or Teitsworth*

**181. Introductory Mechanics. (NS)** Newtonian mechanics at the intermediate level, Lagrangian mechanics, linear oscillations, special relativity. Prerequisite: Mathematics 111 or equivalent (may be taken concurrently). One course. *Roberson*

**182. Electricity and Magnetism. (NS)** Electrostatic fields and potentials, boundary value problems, magnetic induction, energy in electromagnetic fields, Maxwell's equations, introduction to electromagnetic radiation. Prerequisite: Mathematics 111 or equivalent. One course. *Evans*

**185, 186. Modern Optics. (NS)** Optical processes including the propagation of light, coherence, interference, and diffraction. Consideration of the optical properties of solids with applications to modern optical devices. Second semester will emphasize nonlinear interactions, optical modulators, lasers, and spectroscopy. Lecture and laboratory projects. Note: the following cross-listing applies only to Physics 185. C-L: Electrical Engineering 213. One course each. *Guenther or Hacker*

### **For Seniors and Graduates**

**211. Modern Physics. (NS)** Fundamental concepts of quantum theory applied mainly to study of atomic structure and spectra, and to statistical physics. Prerequisites: Physics 181 and Mathematics 111. One course. *Herbst*

**213. Introduction to Nonlinear Dynamics.** See C-L: Computer Science 213. One course. *Greenside*

**214. Introduction to Solid-State Physics. (NS)** See C-L: Electrical Engineering 214. One course. *Hacker*

**215. Introduction to Quantum Mechanics. (NS)** Fundamental postulates; wave mechanics and elementary applications; operators, eigenvalues, and eigenfunctions; angular momentum and rotations; spin and coupling of angular momenta; perturbation theory, transition rates, and selection rules; identical particles; applications. Prerequisites: Physics 181 and 211; Mathematics 111 and 114 (may be taken concurrently). One course. *Robinson*

**217S, 218S. Advanced Physics Laboratory and Seminar. (NS)** Experiments involving the fields of electricity, magnetism, heat, optics, and modern physics. One course each. *Meyer*

**225, 226. Elementary Investigations. (NS)** Training in the laboratory and library methods of physical research. Qualified students may conduct elementary investigations under the supervision of a member of the staff. One course each. *Staff*

**240. Computer Applications to Physical Measurement. (NS)** Hardware and software techniques for computer-assisted data acquisition, display, and control in the modern experimental environment. Theory and application of discrete signal analysis including digital filters, Z-transform, and fast Fourier transform. Lecture and laboratory. Prerequisite: Physics 171 or 220 or consent of instructor. One course. *Fortney*

**244. Nuclear and Particle Physics. (NS)** Current ideas and models in nuclear and particle physics. Experimental methods; nuclear structure; nuclear reactions; families of elementary particles; quarks and gluons; weak interactions. Prerequisite: Physics 211. One course. *Oh*

## COURSES CURRENTLY UNSCHEDULED

**33. Energy: Principles, Problems, Alternatives. (NS)**

**102. Applications of Modern Physics in Medicine. (NS)**

**106. Topics in Astrophysics. (NS)**

**212. Modern Physics. (NS)**

## THE MAJOR

Students majoring in physics are prepared for work in industrial and governmental laboratories. They are also prepared for graduate work in physics or for the study of medicine.

Students planning to major in physics should enroll in Physics 41, 42 in their freshman year. They should also arrange to complete the necessary mathematics as soon as possible.

### For the A.B. Degree

*Prerequisites.* Physics 41, 42 or 51, 52, or equivalents; Mathematics 31, 32, 103, 111, or equivalents, and one additional course at the 100 or 200 level.

*Major Requirements.* Physics 143, 171, 176, 181, and two other courses in physics at the 100 or 200 level.

### For the B.S. Degree

*Prerequisites.* Physics 41, 42 or 51, 52, or equivalents; Mathematics 31, 32, 103, 111, or equivalents, and one additional course at the 100 or 200 level.

*Major Requirements.* Physics 143, 171, 176, 181, 182, 211, and two other courses in physics at the 100 or 200 level, at least one of which must be a laboratory course. Students planning graduate study in physics are urged to take one additional elective in physics and one in mathematics.

## Honors

The department offers upperclassmen the possibility of being associated with research conducted in the department. This work may lead to graduation with distinction. See the section on honors in this bulletin.



## Polish

For courses in Polish, see Slavic Languages and Literatures.

## Political Science (PS)

Professor Kornberg, *Chairman*; Associate Professor Johns, *Director of Undergraduate Studies*; Professors Aldrich, Ascher, Barber, Bates, Braibanti, Fish, Holsti, Horowitz, Hough, Leach, Paletz, Price, and Spragens; Associate Professors Eldridge, Lange, and McKean; Assistant Professors Bianco, Canon, Gillespie, Grant, Grieco, Kitschelt, Lomperis, Niou, Roberts, and Smith; Professors Emeriti Ball, Cleaveland, Cole, Grzybowski, Hall, Hallowell, Kulski, and Simpson; Adjunct Associate Professor O'Barr

A major is available in this department.

Courses in political science for undergraduates are offered in four fields: (A) American government, politics, and public administration; (B) comparative government and politics; (C) political theory and methodology; and (D) international law, relations, and politics. In the course descriptions below the field within which the course falls is indicated by the appropriate letter symbol (A, B, C, or D) after the title of the course. In each field, a course numbered at the 90 level serves as an introduction both to the study of political science and to the subject matter and approaches of the field, and middle and upper level courses and seminars (numbered at the 100 and 200 levels respectively) consider particular aspects and topics within the field. In addition, independent study under faculty supervision enables students to explore topics of special interest. See below, following the course descriptions, for the listing of courses by fields, information on internships, and requirements for the major and honors.

### INTRODUCTORY COURSES

The following courses introduce the study of political science, and each serves as the basic course in one of the four fields of the discipline. Students ordinarily will take at least one of these courses before proceeding to more advanced courses. Some advanced courses may require a particular introductory course as a prerequisite.

**49S. Freshman Seminar.** Topics vary each semester offered. One course. *Staff*

**91. The American Political System (A).** (SS) Theory and practice of American government and politics; federal-state relations; the separation and interrelationships of the executive, legislative, and judicial branches of government; judicial review; the role of political parties and public opinion; the formulation and execution of domestic and foreign policy; civil liberties. One course. *Staff*

**91D. The American Political System (A).** (SS) Same as Political Science 91 except instruction is provided in two lectures and one small discussion meeting each week. One course. *Staff*

**92. Comparative Politics (B).** (SS) Topics include problems of conceptualization and analysis; foundations of politics under democratic, authoritarian, and totalitarian regimes; theories of development and underdevelopment; revolution and collective violence; the role of elites, such as the military. C-L: Comparative Area Studies. One course. *Staff*

**92D. Comparative Politics (B).** (SS) Same as Political Science 92 except instruction is provided in two lectures and one small discussion meeting each week. One course. *Staff*

**93. Elements of International Relations (D).** (SS) The nature of international politics, the analysis of national power, the instruments of foreign policy, and the controls of state behavior. One course. *Staff*

**93D. Elements of International Relations (D).** (SS) Same as Political Science 93 except instruction is provided in two lectures and one small discussion meeting each week. One course. *Staff*

**94. Contemporary Political Ideologies (C).** (SS) Liberalism, socialism, Marxism and its variants, fascism, contemporary democratic theory. One course. *Staff*

**94D. Contemporary Political Ideologies (C).** (SS) Same as Political Science 94 except instruction is provided in two lectures and one small discussion meeting each week. One course. *Staff*

## OTHER UNDERGRADUATE COURSES

**100. Duke University Overseas Semester (C).** (SS) This number represents course credit for political science courses taken either in Duke University Summer Session Study Abroad Programs or in Duke University exchange programs with overseas universities.

- A. Duke Summer Program in Berlin (B). Two courses.
- B. Duke Summer Program in Brazil (B). Two courses.
- C. Duke Summer Program in Zimbabwe/Botswana (BD). Two courses.
- D. Duke Summer Program in Cambridge University (AB). Two courses.
- E. Duke Summer Program in Media and Politics in Europe (B). Two courses.
- F. Duke Summer Program in Israel (B). One course.
- G. Duke Summer Program in Mexico (D). One course.
- H. Duke Summer Program in Bologna (B). One course.  
Variable credit.

**104. Politics and Literature .** (SS) The enduring questions of politics and political philosophy illustrated in Western literature: historical, literary, and philosophical analysis. One course. *Gillespie or Grant*

**106. International Security (D).** (SS) Contemporary and future threats. Regional conflicts, the United States-Soviet strategic balance, theories of deterrence and defense, prospects for arms control. One course. *Staff*

**107. Comparative Environmental Policies (B).** (SS) Comparative analysis of environmental problems and policies in politically diverse industrialized nations including the United States, Russia, and Japan. C-L: Comparative Area Studies and Public Policy Studies 107. One course. *McKean*

**108. The American Presidency (A).** (SS) The presidency and its impact on the American political system. One course. *Canon or Paletz*

**109. State and Local Government Today (A).** (SS) Problems in state, county, and city government. One course. *Leach*

**111. Contemporary Japanese Politics (B).** (SS) Introduction to political change in post-war Japan. Foundations of the modern industrial state, electoral politics, policy-making and bureaucracy, defense, foreign policy, and foreign trade. C-L: Comparative Area Studies. One course. *McKean*

**112S. Shaping the News (A).** (SS) C-L: Public Policy Studies 186S. One course. *Barber*

**113. International Political Economy (D).** (SS) The interplay between politics and economics in international trade, money, investment, and technology flows among advanced capitalist societies, between developed and developing countries, and between capitalist and socialist countries. One course. *Grieco*

**115. Politics and Society in West Germany (B).** (SS) Industrialization, democratization, and fascism in Germany; social structure, political institutions, and political culture;

selected public policies; West Germany in the world economy and in world politics. C-L: Comparative Area Studies. One course. *Kitschelt*

**116S. The Small Democracies in Europe (B). (SS)** Institutions and policy-making in selected small European democracies. Consensus, efficiency, and economic survival of small democracies. One course. *Kitschelt*

**118. American Constitutional Development (A). (SS)** Prerequisite: Political Science 91 or 91D or consent of instructor. One course. *Fish*

**120. International Conflict and Violence (D). (SS)** Nature and processes of international conflict and violence with emphasis on contemporary instances of violence in international affairs. Consideration of restraints on violence. One course. *Eldridge*

**121. International Organization (D). (SS)** Political aspects of military and economic organizations at the global and regional levels of the international system. One course. *Grieco*

**122. Modern International Politics (D). (SS)** The major problems in contemporary international affairs with attention to superpower politics, specific regional concerns, and the problems associated with the emergence of a new international economic order. One course. *Eldridge*

**123. Introduction to Political Philosophy (C). (SS)** The nature and enduring problems of political philosophy, illustrated by selected theorists in the Western political tradition. One course. *Staff*

**125. Strategies of Comparative Analysis (B). (SS)** See C-L: Comparative Area Studies 125; also C-L: Cultural Anthropology 125, History 137, and Sociology 125. One course. *Staff*

**126. Theories of Liberal Democracy (C). (SS)** Critical discussion of classic theorists, such as Locke, Rousseau, Mill, and Madison, and contemporary theories of liberal democracy. One course. *Grant or Spragens*

**127. Law and Politics (A). (SS)** Nature and functions of law; Anglo-American legal institutions; the process of judicial decision making; and the relationships among judges, lawyers, legislators, and administrators in the development of public as well as private law. One course. *Fish*

**128. Congress and the Presidency (A). (SS)** Policy-making in the executive and legislative branches of the United States government, with particular attention to intragovernmental relations. One course. *Bianco or Canon*

**129. Political Participation (A). (SS)** The motives, methods, and results of the activities of individuals and groups and of social movements. C-L: Women's Studies. One course. *Paletz*

**130S. Nongovernmental Organizations and Public Policy (A). (SS)** See C-L: Public Policy Studies 130S. One course. *Smith*

**131. Introduction to American Political Thought (C). (SS)** Basic elements in the American political tradition as developed from its English roots to the present. One course. *Grant or Leach*

**132. Politics of Asia (B). (SS)** The impact of nationalism, development, and revolution on traditional Asian society and its emerging states. C-L: Comparative Area Studies. One course. *Lomperis*

**134. West Germany and East Germany: From Confrontation to Normalization? (D). (FL, SS)** Politics of Germany after World War II; the integration of West Germany into NATO and East Germany into the Warsaw Pact; the political relations between the



German states in an era of superpower conflict. Offered only in the Berlin semester program; taught in German. One course. *Staff*

**135. Political Development of Western Europe (B). (SS)** The development of the modern political systems of Britain, France, Germany, and other European countries; the spread of capitalism, the emergence of mass democracy and the rise of the welfare state. Contemporary developments examined in historical and theoretical perspective. C-L: Comparative Area Studies. One course. *Kitschelt or Lange*

**136. Comparative Government and Politics: Western Europe (B). (SS)** Modern political institutions and processes of European democracies: political parties, interest groups and parliaments; regional, religious, and class divisions; political participation and mobilization; relationships of state, society and economy; political, social and economic change in postwar Europe. C-L: Comparative Area Studies. One course. *Kitschelt or Lange*

**137. Political Behavior in Elections (A). (SS)** An introduction to voting and elections in the United States, with emphasis on presidential nomination and election procedures, characteristics of the American electorate, and theories of voting behavior in presidential and congressional elections. One course. *Aldrich or Bianco*

**138. Quantitative Political Analysis I (C). (QR)** Basic applications of statistical methods to the analysis of political phenomena. Emphasis on research design, descriptive and inferential statistics, and use of computers. Not open to students who have had or are enrolled in Political Science 236, Economics 138, Mathematics 53 or 117, Psychology 117, Public Policy Studies 112 or 222, Sociology 132, 133, or 293, or Statistics 10D or 100. One course. *Staff*

**140. Law and Society (C). (SS)** The evolution of the competing political philosophies of law. Consideration of a variety of standpoints for examining current debates about the nature of law and rights. One course. *Staff*

**141S. Issues in Twentieth-Century American Political Practice (A). (SS)** Recurring themes of debate over the nature of American government. Selected contemporary problems and institutions. Open only to students in the Twentieth-Century America Program. One course. *Staff*

**143S. Politics of Liberties (A). (SS)** Theory and development of the Bill of Rights with attention to Supreme Court decisions and to cultural and political forces. One course. *Fish*

**144S. Issues in Twentieth-Century American Political Theory (C). (SS)** Recurring themes of contemporary debate. Attempts to refurbish or develop alternatives to the dominant liberal tradition. Open only to students in the Twentieth-Century America Program. One course. *Staff*

**145. Political Analysis for Public Policy-Making (A). (SS)** See C-L: Public Policy Studies 114. One course. *Ascher*

**146. American Legislative Behavior (A). (SS)** An introduction to the American legislative process, with specific focus on the U.S. Congress. Emphasis on legislative rules and procedures, congressional elections, and the behavior of legislators in their representative and policy-making roles. One course. *Bianco or Canon*

**147. International Environmental Politics and Policies (D). (SS)** Environmental issues in developing countries in the context of the North-South problem; transboundary pollution problems and international trade; problems of the global commons (such as the deep sea, the upper atmosphere, genetic resources); international organizations and environmental policy. C-L: Comparative Area Studies. One course. *McKean*

**148. The Politics of American Business and Government in the International Economy (D).** (SS) Major political forces which affect United States business operations abroad and the responses to the forces by business and the United States government. One course. *Grieco*

**149. United States and East Asia (D).** (SS) American military intervention in China, Korea, and Vietnam; contemporary United States relations with Japan, China, and other Asian nations; new trends and sources of tension in East Asia and the Pacific. C-L: Comparative Area Studies. One course. *McKean*

**150. The Individual and Society: The Classical View (C).** (SS) Ancient political philosophy and drama emphasizing the case of Socrates. Readings include Plato's *Republic*, *Apology*, and *Crito*; Aristophanes' *The Clouds*; Sophocles' *Antigone*. One course. *Grant*

**151. Introduction to Latin American Politics (B).** (SS) Historical and cultural context of political institutions and behavior, the role of traditional and emerging groups and forces, political instability and the decision-making process. C-L: Comparative Area Studies. One course. *Staff*

**152. Political Thought of the American Founding (C).** (SS) Debate over the Constitution. Readings include Declaration of Independence, Articles of Confederation, the Constitution, the *Debates over the Constitution*, the *Federalist Papers*, and selections of Antifederalist writings. One course. *Grant*

**153, 154. Politics and the Media of Mass Communication 153 (B), 154 (A).** (SS) Analysis of the nature, organization, and products of the mass media (especially the movie, television, and newspaper industries) as they affect the political systems, political processes, institutions, and people of the United States and other nations. Open to juniors and seniors. It is desirable but not required that students taking 153 continue with 154. With consent of the instructor, students who have not taken 153 may enroll in 154. C-L: Film and Video and Women's Studies. One course each. *Paletz*

**156. Space, Weapons, and War (D).** (SS) Space, weapons, and war in international relations. Offense, defense, and space technology. One course. *Roberts*

**157. Foreign Policy of the United States (D).** (SS) Sources of American foreign policy, containment, international economic policy, deterrence, arms control, and disarmament. Prospects for the future. Emphasis on the period since World War II. One course. *Holsti*

**158. Space and International Relations (D).** (SS) A comparative and historical survey of the developments regarding space, emphasizing the relations between states and the international system. The concept of space from fantasy to historical reality, focusing on the role of science, industry, and the administrative state. One course. *Roberts*

**159. Ambition and Politics (C).** (SS) A theoretical examination of the role of ambition in politics, including works by or on Plato, Plutarch, Machiavelli, Shakespeare, Madison, Tocqueville, and Hitler. One course. *Gillespie*

**160. Contemporary International Problems: Their Historical Origins and Their Implications for Future Policy (D).** (SS) C-L: Comparative Area Studies 109, Cultural Anthropology 109, History 109, and Sociology 175. One course. *Staff*

**161S. Comparative Government and Politics: Africa (B).** (SS) Nationalism, nation building, and problems of development in sub-Saharan Africa. C-L: Comparative Area Studies. One course. *Bates or Johns*

**163. Gender, Politics, and Policy: The Third World Case (B).** (SS) A comparative analysis of precolonial, colonial, and postcolonial politics and distribution of political power between women and men. C-L: Comparative Area Studies and Women's Studies. One course. *O'Barr*

**165. Government and Politics of the Soviet Union (B). (SS)** Analysis of the Soviet political system, emphasizing the sources of stability and instability and the responsiveness of its policies. Literature on the non-Soviet world (notably the United States) will be included. C-L: Comparative Area Studies. One course. *Hough*

**166. Soviet Foreign Relations (D). (SS)** Nature of relations with other states. Determinants and formulation of foreign policy. C-L: Comparative Area Studies. One course. *Hough*

**169. Politics in Revolutionary China (B). (SS)** Political process in China since 1949, with emphasis on ideological shifts in the Cultural Revolution and the post-Mao era. Party politics, leadership, economic organization, thought reform, mass mobilization, and socialist transformation. China as an emerging world power. C-L: Comparative Area Studies. One course. *McKean*

**171. Politics of South African Apartheid (B). (SS)** The South African political system in the twentieth century, with particular attention to the economic and ethnic roots of racial conflict. United States-South African relations. C-L: Comparative Area Studies. One course. *Johns*

**173S. Political Economy of World Food Problems (B). (SS)** Changing policies toward food production and distribution. Topics include American agricultural policy, international food and famine aid, and Third World agricultural development strategies. C-L: Comparative Area Studies. One course. *Johns*

**174S. Political Biography (A). (SS)** Nature of politics as revealed in the life histories of individuals. Readings in single biographies and autobiographies, but with some comparative work. Students project their autobiographies toward possible political futures. One course. *Barber*

**176A. Perspectives on Food and Hunger (B). (SS)** See C-L: Interdisciplinary Course 120A; also C-L: Comparative Area Studies. One course. *Johns*

**176B. Perspectives on Food and Hunger (B). (SS)** See C-L: Interdisciplinary Course 120B; also C-L: Comparative Area Studies. One course. *Johns*

**177, 178. Contemporary Social and Political Development in the Islamic World (B). (SS)** An analysis of contemporary events in Iran, Afghanistan, Pakistan, Iraq, and the Arabian Peninsula; the political manifestation of Shi'ia and Sunni Islam; security in the Arab world and its relationship to global politics. Prerequisite: for 178, 177 or consent of instructor. C-L: Comparative Area Studies. One course each. *Staff*

**180. Media in Comparative Perspective (B). (SS)** See C-L: Interdisciplinary Course 182; also C-L: Comparative Area Studies and Sociology 182. One course. *Paletz or Smith*

**184. An Introduction to Canada and Canadian Issues (B). (SS)** See C-L: Interdisciplinary Course 184; also C-L: Canadian Studies, Comparative Area Studies, Economics 184, History 184, and Sociology 184. One course. *Cahow*

**186. Political Leadership (A). (SS)** The development, characteristics, and impact of political leaders. Biographical and collective studies are considered primarily from a psychological perspective. One course. *Barber*

**187. Politics and the Libido (A). (SS)** Effects of the libido on elite and mass political activities. Government regulation of sex-inspired behavior. C-L: Women's Studies. One course. *Paletz*

**188. The Psychology of Political Symbols (A). (SS)** The role of symbolic political issues in determining public attitudes and voting behavior. Symbolic political issues such as "law and order," pornography, and prohibition; distinguished from public welfare issues such as employment policies. C-L: Public Policy Studies 188. One course. *McConahay*



**189, 190. Internship (A).** Open to students engaging in practical or governmental work experience during the summer or a regular semester. To enroll, a student must obtain the approval of the Director of Undergraduate Studies. A faculty member in the department will supervise a program of study related to the work experience, including an analytical paper. One course each. *Johns*

**191, 192. Independent Study (A, B, C, or D).** Directed reading and research. Open only to qualified juniors by consent of the Director of Undergraduate Studies and of the supervising instructor. One course each. *Staff*

**193, 194. Independent Study (A, B, C, or D).** Directed reading and research. Open only to seniors by consent of the Director of Undergraduate Studies and of the supervising instructor. One course each. *Staff*

**196 (I-IV). American University Washington Semester (A).** This number represents transfer course credit for courses taken at American University in the Washington Semester Program: Washington Semester Seminar I, Washington Semester Seminar II, Washington Semester Internship, and an elective or research project. If any of the above courses at American University are taken outside the political science department, approval must be obtained beforehand from the Director of Undergraduate Studies of the appropriate Duke department in order to obtain transfer credit. Four transfer credits. Four courses.

**199. Special Topics in Government and Politics. (SS)** Topics vary from semester to semester.

- A. American Government and Politics
  - B. Comparative Government and Politics
  - C. Political Theory
  - D. International Relations
- One course. *Staff*

#### For Seniors Only

**197S-198S. Senior Honors Thesis.** Preparation and writing of research paper; group meetings to present topics and for discussion. Open only to senior political science majors in the honors program. See section on honors under description of the major. Two courses. *Staff*

**200S. Senior Seminars. (SS)** Open also, if places are available, to qualified juniors who have earned a 3.0 average and obtained the consent of the instructor.

- A. American Government and Politics
  - B. Comparative Government and Politics
  - C. Political Theory
  - D. International Relations
- One course. *Staff*

#### For Seniors and Graduates\*

**201S. Problems in International Security (D). (SS)** Major security issues. Prerequisite: a course in international relations or American foreign policy. One course. *Staff*

**203S. Issues and Problems in Politics and the Media (A). (SS)** Research seminar analyzing significant questions in the relationship between politics and the media of communication. Prerequisite: consent of instructor. C-L: Film and Video. One course. *Paletz*

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\*The following courses may be taken by juniors who have earned a 3.0 average and obtained the consent of the instructor.

**204S. Ethics in Political Life (C). (SS)** Ethical issues arising in the conduct of political vocations and activities. C-L: Public Policy Studies 204S. One course. *Spragens*

**207S. American Constitutional Interpretation (A). (SS)** Development of the Constitution of the United States through Supreme Court decisions. One course. *Fish*

**208S. Analyzing the News (A). (SS)** See C-L: Public Policy Studies 240S. One course. *Entman*

**209. Problems in State Government and Politics (A). (SS)** One course. *Leach*

**212S. Domestic Structures and Foreign Policies of Advanced Democratic States (D). (SS)** The influence of democratic institutions on the national-security and foreign-economic policies of advanced industrialized states. C-L: Comparative Area Studies. One course. *Grieco*

**213S. Theories of International Political Economy (D). (SS)** Comparison and assessment of traditional and modern theories in terms of their logical and empirical validity. One course. *Grieco*

**216S. Evolution of European Marxism (C). (SS)** The central themes in the evolution of European Marxism: socialist thought prior to Marx; the writings of Marx and Engels. The themes are articulated in: Russian Marxism; Soviet Communism and its Marxist critics; the rethinking of Marx's political economy, the theory of the state, and concepts of class consciousness in the works of twentieth-century European Marxists. C-L: Comparative Area Studies. One course. *Staff*

**218. Political Thought in the United States (C). (SS)** American political thought through the Civil War period. The Founders and their European antecedents. Debates over the Constitution, slavery, and the Union. One course. *Gillespie or Grant*

**220S. Problems in International Politics (D). (SS)** Prerequisite: one course in international relations, foreign policy, or diplomatic history. One course. *Holsti*

**221S. International Institutions and the World Political Economy (D). (SS)** Examination of theory concerning the role of international institutions in facilitating economic cooperation among advanced democratic states. Investigation of the impact on international economic relations of such multilateral institutions as the International Monetary Fund, the World Bank, the General Agreement on Tariffs and Trade, and the International Energy Agency. One course. *Grieco*

**223. Ancient Political Philosophy (C). (SS)** Intensive analysis of the political philosophy of Plato, Aristotle, and other ancient theorists. One course. *Gillespie or Grant*

**224S. Modern Political Theory (C). (SS)** A historical survey and philosophical analysis of political theory from the beginning of the seventeenth to the middle of the nineteenth century. The rise of liberalism, the Age of Enlightenment, the romantic and conservative reaction, idealism and utilitarianism. One course. *Grant or Spragens*

**225. Topics in Comparative Government and Politics: Western Europe (B). (SS)** Topics vary: the development of mass democracy and the welfare state; political and electoral participation and mobilization; social movements and political change; center-periphery conflicts; government and bureaucratic institutions and their relationships to society; the modern welfare state and political economy. C-L: Comparative Area Studies. One course. *Kitschelt or Lange*

**226S. Theories of International Relations (D). (SS)** An overview with applications to political-military and political-economic empirical problems. One course. *Grieco*

**228S. Nineteenth- and Twentieth-Century Political Philosophy (C).** (SS) Topics in nineteenth- and twentieth-century political philosophy, considering such authors as Hegel, Marx, Nietzsche, Dostoevsky, Heidegger, Malraux, and Camus. One course. *Gillespie*

**229S. Contemporary Theory of Liberal Democracy (C).** (SS) One course. *Spragens*

**230S. Introduction to Positive Political Theory (C).** (SS) Basic concepts of political economy, theory of preference and choice, social choice theory, and decision and game theory. One course. *Aldrich, Bates, Bianco, or Niou*

**231S. Crisis, Choice, and Change in Advanced Democratic States (B).** (SS) Contributions of Marx, Weber, and Durkheim toward analysis of modern democracies. Examination of selected contemporary studies using these three perspectives to highlight processes of change and crisis. Unsettling effects of markets upon political systems, consequences of bureaucratic regulation, and transformation of sources of solidarity and integration in modern politics. C-L: Comparative Area Studies. One course. *Kitschelt*

**232. Political Economy: Theory and Applications (C).** (SS) Selected topics. C-L: Comparative Area Studies. One course. *Lange*

**233S. Quantitative Political Analysis II (C).** (QR) Intermediate statistical methods, especially linear regression, for political science research. Emphasis on assumptions and interpretations of results. Prerequisite: Political Science 138 or 236 or equivalent. One course. *Staff*

**235S. Comparative Development of Islam (B).** (SS) Comparative development of Islam in Indonesia, Malaysia, Pakistan, India, North Africa, and sub-Saharan Africa. A comparative analysis of the resurgence of Islam as a religious, political, and cultural force. One course. *Staff*

**236. Statistical Analysis (C).** (QR) Introduction to statistics in political research, emphasizing research design, descriptive and inferential statistics, and use of computers. Not open to students who have had or are enrolled in Political Science 138, Economics 138, Mathematics 53 or 117, Psychology 117, Public Policy Studies 112 or 122, Sociology 132, 133, or 293, or Statistics 10D or 100. One course. *Staff*

**237S. Comparative Public Policy (B).** (SS) Introduction to methods, concepts, and theories of comparative public policy analysis. Substantive policies examined in the course vary each semester and may include economic, industrial, social, and civil rights policies. C-L: Comparative Area Studies. One course. *Kitschelt*

**240. American Political Behavior (A).** (SS) One course. *Staff*

**242S. Comparative Law and Policy: Ethnic Group Relations (B).** (SS) Various approaches to the reduction of conflict in deeply divided societies, primarily in Asia and Africa, with secondary attention to Western countries. The nature of ethnic identity, the sources of group conflict, and the forms and patterns it takes. Methods of analyzing social science materials and utilizing them for the design of policies, laws, and institutions. Prerequisite: consent of instructor. C-L: Comparative Area Studies. One course. *Horowitz*

**243S. Political Applications of Game Theory (C).** (SS) Theory of games as a tool to understand strategic behavior of political actors. Applications to legislative politics, international cooperation, bureaucratic behavior. One course. *Bianco or Niou*

**245. Ethics and Policy-Making (C).** (SS) Not open to students who have taken Public Policy Studies 116. See C-L: Public Policy Studies 223. One course. *Rapaport*

**246S. Political Hypocrisy and Idealism (C).** (SS) The cases for and against hypocrisy in political and social life. The concept of authenticity as the alternative to hypocrisy. Selections from Machiavelli, Shakespeare, Rousseau, Nietzsche, and others. One course. *Grant*



**248. The Politics of the Policy Process (A).** (SS) See C-L: Public Policy Studies 219. One course. *Entman*

**249. Comparative International Development and Technology Flow (B).** (SS) Analysis of social, political, and economic development in Third World countries. The internal problem of maintaining political systems and the external problem of adapting intermediate or appropriate technologies. C-L: Comparative Area Studies. One course. *Staff*

**251S. The American Presidency (A).** (SS) One course. *Paletz*

**253S. Comparative Government and the Study of Latin America (B).** (SS) Current literature on major themes of Latin American politics. C-L: Comparative Area Studies. One course. *Staff*

**255. Political Sociology (B).** (SS) See C-L: Sociology 255. One course. *Smith or Tiryakian*

**256S. Arms Control and National Security Policy (D).** (SS) The evolution of nuclear weapons and strategy and of global defense policy toward the Soviet Union and other adversaries; the arms control process and nonproliferation. Prerequisite: consent of instructor. One course. *Lomperis*

**259S. Low Intensity Conflict and the Lessons of Viet Nam (D).** (SS) The Viet Nam conflict and comparative cases; implications for Western interventions in the Third World. Prerequisite: consent of instructor. C-L: Comparative Area Studies. One course. *Lomperis*

**260S. The Tradition of Political Inquiry (C).** (SS) Past and present problems, goals, presuppositions, and methods. One course. *Spragens*

**262S. International Communism (D).** (SS) C-L: Comparative Area Studies. One course. *Hough*

**263S. Methods of Political Science (C).** (SS) The relation between theory and evidence; research designs for the comparative analyses of historical and statistical evidence. One course. *Roberts*

**264S. Feminist Theory and the Social Sciences (A).** (SS) See C-L: Interdisciplinary Course 284S; also C-L: Cultural Anthropology 284S, History 284S, Psychology 284S, Sociology 284S, and Women's Studies. One course. *Chafe, Neuschel, O'Rand, C. Smith, or Spenner*

**267S. Policy-Making in International Organizations (D).** (SS) See C-L: Public Policy Studies 267S. One course. *Ascher*

**270S. Fundamentals of Political Economy (C).** (SS) Application of economic reasoning to the study of politics. Analysis of campaigns and elections; legislatures; and the regulation of industries. C-L: Economics 270S. One course. *Aldrich, Bates, Bianco, or Niou*

**275. The American Party System (A).** (SS) An intensive examination of selected facets of American national political parties, such as relationships between presidential and congressional politics, the politics of national conventions, recent foreign policy and party alignments, and the controversy over party government. One course. *Kornberg*

**277. Comparative Party Politics (B).** (SS) The impact of social and political systems on party structures, functions, ideologies, and leadership recruitment. Emphasis upon research techniques and objectives. C-L: Comparative Area Studies. One course. *Kornberg or Lange*

**279S. Political Protest and Collective Mobilization (B).** (SS) Survey of theories, methods, and empirical studies of political mobilization outside institutional channels; protest behavior and strategies; responses of the state to these challenges; the success of collective mobilization. Emphasis on comparative analyses of protest in advanced industrial democracies. One course. *Kitschelt*

**282S. Canada (B). (SS)** See C-L: History 282S; also C-L: Canadian Studies, Comparative Area Studies, Cultural Anthropology 282S, Interdisciplinary Course 282S, and Sociology 282S. One course. *Cahow*

**283S. Congressional Policy-Making (A). (SS)** Lawmaking and oversight of the executive branch by the U.S. Congress. Committee, party, executive, and interest group roles. C-L: Public Policy Studies 283S. One course. *Bianco or Canon*

**284S. Public Policy Process in Developing Countries (B). (SS)** See C-L: Public Policy Studies 284S; also C-L: Comparative Area Studies. One course. *Ascher*

**286S. Judicial Administration (A). (SS)** Organization, case processing, and management of courts with emphasis on federal appellate courts. Prerequisite: Political Science 127. One course. *Fish*

**293. Federalism (B). (SS)** Theoretical and operational aspects of federal systems of government, focusing on the United States and Canada. C-L: Canadian Studies and Comparative Area Studies. One course. *Leach*

**299. Advanced Topics in Government and Politics. (SS)** Topics vary from semester to semester.

- A. American Government and Politics
  - B. Comparative Government and Politics
  - C. Political Theory
  - D. International Relations
- One course. *Staff*

#### COURSES CURRENTLY UNSCHEDULED

**110. The Americas: A Survey of the Forces Shaping the Hemisphere (B). (SS)**

**114. United States Foreign Policy and Latin America (D). (SS)**

**117. Comparative Government and Politics: Selected Countries (B). (SS)**

**155. The Politics and Economics of Developing Areas (B). (SS)**

**167. International Law (D). (SS)**

**172. Political Economy of Global Natural Resources (B). (SS)**

**175. Political Parties and Legislatures in Western Democracies (B). (SS)**

**195. Comparative Political Behavior in the United States and Canada (B). (SS)**

**211S. Current Problems and Issues in Japanese Politics (B). (SS)**

**214S. The Politics of Scarcity (B). (SS)**

**215S. Philosophical Bases of Political Economy and Society (C). (SS)**

**222S. Seminar: Modern Political Classics (C). (SS)**

**234S. Political Economy of Development: Theories of Change in the Third World (B). (SS)**

**261. Politics and the Future (D). (SS)**

**280S. Comparative Government and Politics: Sub-Saharan Africa (B). (SS)**

#### POLITICAL INTERNSHIPS

The department administers an internship program, primarily in Washington, D.C., for political science majors and interested nonmajors. Students participate by qualify-

ing for a position obtained by the department or by acquiring their own relevant employment, with or without compensation. Course credit can be obtained by enrolling in Political Science 189 or 190 and writing an analytical paper. Potential applicants should contact the Internship Director, Louise Walker (327 Perkins), at any time, but preferably in the fall semester.

## POLITICAL SCIENCE COURSES BY FIELDS

Political science courses for undergraduates are offered in four fields. The courses in each of the four fields are listed below; in the course descriptions above, the field in which each course falls is indicated by the appropriate symbol (A, B, C, or D). Students majoring in the department must complete at least one course in each of three fields.

**American Government, Politics, and Public Administration (A).** Political Science 91, 91D, 100D, 108, 109, 112S, 118, 127, 128, 129, 130S, 137, 141S, 143, 145, 146, 154, 174S, 186, 187, 188, 189, 190, 191,\* 192,\* 193,\* 194,\* 196, 197S-198S,\* 199A, 200S A, 203S, 207S, 208S, 209, 240, 248, 251S, 264S, 275, 283S, 286S, 299A.

**Comparative Government and Politics (B).** Political Science 92, 92D, 100A, 100B, 100C, 100D, 100E, 100F, 100H, 107, 110, 111, 115, 116S, 117, 125, 132, 135, 136, 151, 153, 155, 161S, 163, 165, 169, 171, 172, 173S, 175, 176A, 176B, 177, 178, 180, 184, 191,\* 192,\* 193,\* 194,\* 195, 197S-198S,\* 199B, 200S B, 211S, 214S, 225, 231S, 234S, 235S, 237S, 242S, 249, 253S, 255, 277, 279S, 280S, 282S, 284S, 293, 299B.

**Political Theory and Methodology .** Political Science 94, 94D, 104, 123, 126, 131, 138, 140, 144S, 150, 152, 159, 191,\* 192,\* 193,\* 194,\* 197S-198S,\* 199C, 200S C, 204S, 215S, 216S, 218, 222S, 223, 224S, 228S, 229S, 230S, 232, 233S, 236, 243S, 245, 246S, 260, 263S, 270S, 299C.

**International Law, Relations, and Politics (D).** Political Science 93, 93D, 100C, 100G, 106, 113, 114, 120, 121, 122, 134, 147, 148, 149, 156, 157, 158, 160, 166, 167, 191,\* 192,\* 193,\* 194,\* 197S-198S,\* 199D, 200S D, 201S, 212S, 213S, 220S, 221S, 226S, 256S, 259S, 261, 262S, 267S, 299D.

## THE MAJOR

*Requirements.* Eight courses in political science including (1) at least one course in each of three fields; (2) at least one course at Duke at the 200-299 level; and (3) no more than three cross-listed courses originated outside the Department of Political Science. Such courses cannot be used to meet the major requirements in both political science and also in another department. (Cross-listed courses appear in the preceding listing without descriptions.)

Of the eight required political science courses, at least six must be taken at Duke to meet major requirements, five if the student: (1) is transferring courses from a year-long approved study abroad program; or (2) transferred to Duke after completing two undergraduate years at another institution; or (3) completed one semester at an approved study abroad program and one semester at the Washington Semester Program at American University. For the purpose of this requirement courses in the Washington Semester Program at American University will be counted as transfer courses.

*Advanced Placement Credit.* If advanced placement credits in political science have been granted, they may be applied toward the thirty-four credits needed for graduation, but they may not be applied to the political science major.

*Suggested Work in Related Disciplines.* Several courses in such disciplines as anthropology, economics, history, philosophy, psychology, public policy, religion, and sociology are desirable.

*Honors.* The department offers students majoring in political science a senior honors program, by successful completion of which a participant achieves graduation with distinction in political science. The central feature and requirement of the program is the honors thesis which the student prepares under faculty supervision. Students who have attained at least a 3.3 grade average overall and a 3.5 average in political science courses may enter the program by submitting, prior to the end of the second semester of the junior year, a research proposal to the departmental honors committee and also obtaining consent of a faculty member to supervise the proposed thesis. In the first semester of the

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\*If subject matter is appropriate to the field.



senior year, accepted students take Political Science 197S with emphasis on research methods. The following semester they take Political Science 198S during which their thesis is written, presented orally, and evaluated by the honors committee. Graduation with distinction is awarded to students receiving a grade of A- or better. Further information may be obtained from the chairman of the honors committee or the Director of Undergraduate Studies.

## Psychology (PSY)

Professor R. Erickson, *Chairman and Director of Undergraduate Studies*; Professors Alexander, Carson, Coie, Costanzo, Diamond, C. Erickson, W. G. Hall, Hasher, Martin Lakin, Lockhead, Rubin, Staddon, M. Wallach, Wing, and Wolbarsht; Associate Professors Day, Eckerman, Holland, and Roth; Assistant Professors Kremen and Putallaz; Professors Emeriti Borstelmann, Kimble, and H. Schiffman; Adjunct Professors Brodie, Crovitz, George, W. C. Hall, Maddox, S. Schiffman, Thompson, L. Wallach, and Weiss; Adjunct Associate Professors Goldstein, Marsh, and Spenner; Adjunct Assistant Professors Cooper, Musia Lakin, Lindahl, Lochman, and Swartzwelder; Lecturers Casseday, Hoyle, Izard, Sawyer, and Woody

A major is available in this department.

The *General Courses*, coded (G), apply as indicated. The *Biological Bases of Behavior* area, coded (B), includes courses on the nervous system, the learning process, motivation, neurochemistry, hormones, and other biological factors in their relationship to behavior. The *Cognitive Psychology* area, coded (C), includes the topics of sensation and perception, cognition, learning, language, memory, and psycholinguistics. *Developmental Psychology*, coded (D), emphasizes the developmental aspects of all psychological processes such as sensory and motor behavior, cognition, children's thinking and reasoning, and social behavior. Courses in the *Personality/Social Psychology* area, coded (P), ultimately bear on the questions of human character and behavior, both normal and abnormal. These include personality, social and abnormal issues, along with strategies for the prevention of deviance.

### GENERAL COURSES

**11. Introductory Psychology (G). (SS)** Biological bases of behavior, psychological development, cognitive psychology, personality, abnormal behavior, and social psychology. Designed as a broad introduction to psychology for nonmajors as well as majors; not required for the major. Students are expected to participate as subjects in three to six hours of psychological research. One course. *Staff*

**49S. Freshman Seminar.** Topics vary each semester offered. One course. *Staff*

**103. Biological Bases of Behavior: Introduction and Survey (B). (NS)** Physiological, developmental, and evolutionary approaches to behavior. Sensory and cognitive processes, sleep, pain, emotion, hunger, and thirst as well as maternal and sexual behavior patterns. Prerequisite: Biology 14L or Biology 21L; may be taken concurrently. One course. *C. Erickson and staff*

**105. Developmental Psychology: Introduction and Survey (D). (SS)** Theory and research on growth and behavior from infancy to adolescence. One course. *Goldstein or Putallaz*

**107. Cognitive Psychology: Introduction and Survey. (C) (SS)** Overview of cognitive processes including pattern recognition, concept formation, attention, memory, imagery, language, problem solving, and thinking. Emphasis both empirical and theoretical. One course. *Day*

**108. Personality and Social Behavior: Introduction and Survey (P).** (SS) The determinants of socially significant human behavior—those residing in the person, those that are the product of interpersonal context, and those resulting from the interaction of both sources. Formative as well as contemporary influences considered. One course. *Carson or Costanzo*

**110. Applied Psychology (P).** (SS) Applications of psychology to problems of personnel selection, industrial efficiency, advertising, and selling. Prerequisite: Psychology 117 or equivalent. One course. *Staff*

**111. Learning and Adaptive Behavior (B, C).** (NS) Principles of instrumental learning in animals and humans. Prerequisite: none, but some knowledge of quantitative science desirable. C-L: Biology 111. One course. *Staddon*

**112. Sensation and Perception (C).** (SS) Principles of organization of perceptual systems, including sensory systems (vision, audition, proprioception, and chemical senses); pattern recognition; perceptual anomalies; attention; methods of measurement. One course. *Lockhead*

**114. Personality (P).** (SS) Representative theories of personality from Freud to the present, emphasizing problems of normal personality structure, dynamics, development, and assessment. One course. *Alexander or Kremen*

**115. Introduction to Learning Theory (C).** (SS) Simple processes of learning, memory, and motivation, primarily nonhuman, from the perspectives of associationism, ethology, and cognitive science. One course. *Holland*

**116. Social Psychology (P).** (SS) Problems, concepts, and methods in the study of social interaction and interpersonal influence. C-L: Sociology 106 and Women's Studies. One course. *Costanzo or George*

**117. Statistical Methods (G).** (QR) Elementary statistical techniques and their application to the analysis and interpretation of social science data. Theory of inference is stressed. Not open to students who have had Mathematics 136, Statistics 100, Statistics 200, or equivalent. C-L: Sociology 133. One course. *Staff*

**118. The Psychology of Individual Differences (B, C, D, G, P).** (SS) Nature and causes of individual and group variations in intelligence, special abilities, social and emotional characteristics. Prerequisite: Psychology 117 or equivalent. One course. *Staff*

**119. Abnormal Psychology (P).** (SS) Disordered behavior and constructive personality change viewed in interpersonal and social context for purposes of understanding normal and abnormal personality development and functioning. One course. *Carson or Lindahl*

**120. Comparative Psychology (B).** (SS) A survey of animal behavior from the psychologist's perspective. Analysis of several specific behaviors: such as navigation, communication, social organization. One course. *Holland*

**123. Introduction to Human Memory (C).** (SS) A review of the theoretical and empirical study of the encoding, storage, and retrieval of information. The development, pathology, and computer modeling of memory in clarification of basic process and applications. One course. *Hasher or Rubin*

**124. Human Development (D).** (SS) Biological, behavioral, and cultural perspectives and approaches. Evaluation of competing paradigms. Taught by multidisciplinary team. C-L: Human Development, Interdisciplinary Course 124, and Sociology 124. One course. *Maddox and staff*

- 126. Behavior and Neurochemistry (B, P). (NS)** The role of brain chemicals (neurotransmitters, peptides, and hormones) in behavior. Hypotheses addressing the neurobiology of mental disorders. Prerequisite: Psychology 103. One course. *Cooper*
- 130. Psychosocial Aspects of Human Development (D). (SS)** The connectedness of societal, behavioral, and biological components of normal development from childhood through old age; society as the context in which individuals develop over the lifespan. Introductory work in anthropology, psychology, or sociology recommended. C-L: Human Development, Interdisciplinary Course 180, and Sociology 169. One course. *Martin Lakin and Maddox*
- 134. Psychology of Language (C). (SS)** Psychological "reality" of linguistic structures, language and cognition, biological bases, animal communication, language pathologies, nonverbal communication, language versus music, linguistic universals, and bilingualism. Everyday language phenomena (for example, slips of the tongue) as well as the experimental and theoretical literature. Prerequisite: Psychology 107 desirable. C-L: Linguistics. One course. *Day*
- 136. Advanced Developmental Psychology (D). (SS)** Issues, concepts, and methods in psychological development, for example, comparative social development, social cognition, adolescence. Prerequisite: Psychology 105 or consent of instructor. One course. *Eckerman or Putallaz*
- 137. Adolescence (D). (SS)** Adolescent development, including identity formation, intelligence, sexuality, peer and parent relationships, vocational choices, drugs, and psychopathology. Theory and empirical findings. One course. *Goldstein*
- 140S. Research Methods in Developmental Psychology (D). (SS)** Prerequisite: Psychology 105 or consent of instructor. One course. *Eckerman or L. Wallach*
- 141S. Tests and Measurements (B, C, D, G, P). (SS)** Test methods used by psychologists to measure and evaluate mental processes. Prerequisite: Psychology 117 or equivalent. One course. *Staff*
- 142S. Child Observation (D). (SS)** Observation of children in the group setting of the University Preschool and Primary Program. Aspects of personality, social development, and child-adult relationships. Open only to junior and senior psychology majors with consent of instructor. One course. *Musia Lakin*
- 143. Experimental Methods in Cognitive Psychology (C). (SS)** Human cognition; language, memory, problem solving, and other higher mental processes. Prerequisite: Psychology 107 or 112. One course. *Hasher, Lockhead, or Rubin*
- 143S. Cognition Laboratory (C). (SS)** Human cognition; language, memory, problem solving, and other higher mental processes. Prerequisite: Psychology 107 or 112 or 123. One course. *Hasher, Lockhead, or Rubin*
- 145S. Experimental Approaches to Personality (P). (SS)** Methods applied to personality research. Prerequisite: one course in psychology. One course. *M. Wallach*
- 148S. Sensation and Perception Laboratory (C). (SS)** Experimental approaches to basic phenomena of perception as determined by conditions in the external situation and the person: biological and psychological. Prerequisite: Psychology 112 or consent of instructor. One course. *Lockhead*
- 149S. Methods in Behavioral Neurobiology (B). (NS)** Research in neural bases of behavior using simple biological systems as models for more complex behavior. Laboratory experience in experimental methodologies. Observational techniques in study of natural behaviors and neurophysiological recording and stimulation. Prerequisites: Psychology 103 or background in biology and consent of instructor. One course. *W. G. Hall and Staff*



**150S. Hormones and Behavior (B, P). (NS)** The endocrine system and hormones in aggressive, sexual, and emotional behavior. Prerequisites: Psychology 103 and consent of instructor. C-L: Women's Studies. One course. *Izard*

**154S. Education, Children, and Poverty (D). (SS)** Psychological hypotheses concerning the roles of preschool intervention programs, improved quality of resources, teacher expectancy effects, and enhancement of pupil self-confidence, in relation to the goal of improved cognitive competence for poverty background children. Criteria for defining competence, such as scores on psychometric intelligence tests, performing on Piagetian tasks, and development of specific skills. Interpretations concerning intelligence and cognitive deprivation in poor children in light of relevant psychological evidence. Prerequisite: one course in psychology or consent of instructor. One course. *M. Wallach*

**157S. Social Development of Children (D). (SS)** The study of the child's social self; specifically, how children's social behavior changes developmentally and what factors influence the development of that behavior. One course. *Coie or Putallaz*

**159S. Biological Psychology of Human Development (B, D). (SS)** Multidisciplinary perspectives bearing on key processes in human development from infancy through old age; the way that biological and psychological processes act together in normal and pathological behavior and development. Clinical case material and videotapes. Preference given to senior psychology majors and to students in the Program in Human Development. Prerequisite: consent of instructor. One course. *Thompson*

**161S. Advanced Learning Theory (C). (SS)** Selected topics in the data and theory of basic processes of learning, memory, and motivation in animals and humans. Emphasis on the nature of theory construction and evaluation, and the relation of current perspectives to older ones. Prerequisite: Psychology 115 or consent of instructor. One course. *Holland*

**162S. Clinical Issues: Conceptions, Techniques, and Problems of Professional Clinical Psychology (P). (SS)** Assessment of personality and psychopathology. Consultation and psychotherapy in individuals, groups, family, and organizational contexts. Research on clinical questions. Intended for those contemplating advanced graduate or professional study and careers in clinical psychology, counseling, psychiatry, social work, or cognate fields. Prerequisites: junior or senior status and consent of the instructor. One course. *Martin Lakin*

**163S. Stress and Coping (P). (SS)** Psychological theory and empirical work on stress and coping, with an emphasis on post-traumatic stress. Open only to psychology majors. Prerequisite: consent of instructor. One course. *Roth*

**164S. Psychology of Women (P). (SS)** The psychology of women in this country: development, including sex differences, separation and individuation, and achievement; sexuality; sex-roles; mental health problems particularly salient to women; cultural influences on female development; and views within the field of psychology about women. Prerequisite: consent of instructor. C-L: Women's Studies. One course. *Roth*

**165S. Neurobiology of Learning and Memory (B). (NS)** Readings in the neurophysiological and neurochemical underpinnings of the memory process. Current and classical research and review articles. Prerequisites: Psychology 103 and consent of instructor. One course. *Swartzwelder*

**169S. Eating Behavior and Disorders (B, P). (SS)** The interaction of taste and smell with obesity, anorexia, and nutritional status including that of the elderly. Prerequisite: consent of instructor. One course. *Schiffman*

**170S. A-R, U-Z. Selected Problems (G).** New courses not yet in the bulletin are designated as 170S or 270S depending on their level. Since all faculty offer these courses, their contents vary accordingly. Different courses indicated by the letter. One course. *Staff*

**171T. A-R. Tutorials (G).** Small group discussions about influential books and articles in psychology. The availability of tutorials, their content, and the instructors will be announced before registration. Pass/fail grading only. Prerequisite: consent of instructor. Half course. *Staff*

**191, 192, 193, 194. Independent Study (G).** Directed reading and research. 191, 192: junior year fall, spring; 193, 194: senior year fall, spring. Prerequisites: consent of instructor and Director of Undergraduate Studies. One course each. *Staff*

### **For Advanced Undergraduates and Graduates**

**200. Advanced Neuroscience I (B). (NS)** Basic neuroanatomy and neurophysiology, physiology of the neuron and neural networks, neurotransmitter functions, sensory and motor systems. Prerequisite: Psychology 103. C-L: Biology 200 and Interdisciplinary Course 200. One course. *Cant and McClay*

**201. Advanced Neuroscience II (B). (NS)** Integrative activities of the nervous system; sensory-motor relationships, neuroendocrine relationships, emotion and motivation, sleep, learning and memory, diseases of the nervous system and their psychological correlates. Prerequisite: Biology 200, Interdisciplinary Course 200, or Psychology 200. C-L: Interdisciplinary Course 201. One course. *R. Erickson and W. G. Hall*

**203S. Sensation and Perception (C). (SS)** Classical and current concepts and methods. Prerequisite: consent of instructor. One course. *Lockhead*

**204S. Great Ideas in Psychology (G). (SS)** Ideas in psychology drawn from various content areas (for example, perception, personality, motivation, biological bases, social, cognitive, developmental, learning, clinical) and various methodological approaches (for example, experimental, introspection, observation, interview, longitudinal, simulation). Prerequisites: must be a junior or senior psychology major and have consent of instructor, or have graduate status. One course. *Day*

**207S. Topics in Psychobiology (B). (NS)** The biological substrates of human behavior in health and disease. Drug abuse, alcoholism, depression, schizophrenia, and human aggression. Films and videotapes. Student presentations; patient interviews. Prerequisites: senior standing and consent of instructor. C-L: Distinguished Professor Course 207S. One course. *Brodie*

**210S. Cognition (C). (SS)** Schematic view of cognitive psychology plus intensive study of two to three specific research topics such as forms of representation, individual differences, and problem-solving models. Emphasis on alternative experimental and theoretical approaches. Prerequisites: Psychology 107 and consent of instructor, or graduate status. One course. *Day*

**212S. Human Memory (C). (SS)** Classical and modern literature, data, and theories relating to mechanisms of information processing, storage, and retrieval. Prerequisite: consent of instructor or graduate status. One course. *Hasher or Rubin*

**214S. Development of Social Interaction (D, P). (SS)** Major concepts and methods pertaining to early social development, emphasizing human social behavior and a developmental psychobiological approach. Prerequisite: consent of instructor. One course. *Eckerman*

**215S. Cognitive Development (C, D). (SS)** Intensive critical evaluation of major approaches to the development of knowledge, including those of Piaget, Thomas Kuhn, Vygotsky, Eleanor Gibson, Kohlberg, and others. Prerequisite: consent of instructor. One course. *L. Wallach*

**217S. Advanced Social Psychology (P). (SS)** The psychology of interpersonal influence and control; the cognitive and social factors affecting the perception of persons and

social action; the dynamics of interpersonal relations and relationship formation and change; the contribution of individual differences to social behavior. Applications in environmental psychology, social psychology and law, and organizational psychology. Prerequisite: consent of instructor or graduate status. One course. *Costanzo*

**219S. Physiological Foundations of Psychology (B, P). (NS)** Structure and function of the nervous system as related to problems of sensory-motor processes, learning, motivation, and memory. Prerequisite: consent of instructor or graduate status. One course. *C. Erickson and R. Erickson*

**220S. Psycholinguistics (C). (SS)** Selected topics such as neurolinguistics, linguistic versus pictorial representation, individual differences, oral versus written expression, language and personality, and the language-thought interaction. Prerequisites: Psychology 134 and consent of instructor or graduate status. One course. *Day*

**230S. Social Behavior of Animals (B, D, P). (SS)** Developmental, ecological, and physiological aspects of territorial, sexual, parental, and aggressive behavior. Prerequisite: consent of instructor. One course. *C. Erickson*

**234S. Advanced Personality (P). (SS)** Selected topics of current interest concerning empirical research on personality. Strategies for the definition of research questions and the evaluation of research progress. Prerequisite: consent of instructor or graduate status. One course. *M. Wallach*

**238S. Psychophysiology (B). (NS)** How emotional and cognitive processes are expressed physiologically and recorded from heart, skin, muscle, and brain activity. Discussion of major research papers in the field; focus on outlining what is known and developing an understanding of the major issues in psychophysiology. Topics include: sleep, selective attention, memory, language processes, lie detection, and differentiation between arousal, anger, and fear. Laboratory. One course. *Marsh*

**266S. Comparative Neurobiology (B). (NS)** The evolution and functional organization of the vertebrate brain. A study of the original papers of the pioneers in comparative anatomy. Prerequisite: consent of instructor or graduate status. One course. *Diamond and W. C. Hall*

**267S. Brain Mechanisms of Behavior (B, C). (NS)** General physiological principles of brain organization in relation to behavioral processes from sensation to concept formation. Discussions of original readings from seminal papers in the early nineteenth century to the present. Prerequisite: consent of instructor or graduate status. One course. *R. Erickson*

**270S. A-R, U-Z. Selected Problems (G).** New courses not yet in the bulletin are designated as 170S or 270S depending on level. Since all faculty offer these courses, their contents vary accordingly. Different courses indicated by the letter. One course. *Staff*

**273S. Statistical Principles in Experimental Design (G). (QR)** The problems of scientific inference; methods of data analysis and issues in experimental design. Prerequisite: consent of instructor or graduate status. One course. *Roth or staff*

**284S. Feminist Theory and the Social Sciences. (SS)** See C-L: Interdisciplinary Course 284S; also C-L: Cultural Anthropology 284S, History 284S, Political Science 264S, Sociology 284S, and Women's Studies. One course. *Chafe, Neuschel, O'Rand, C. Smith, or Spenner*

**289S. Psychology of Prevention (P). (SS)** Concepts of prevention and mental health promotion; community psychology and social systems; epidemiology and prediction of disorder; intervention strategies; evaluation of prevention trials; and ethical and cultural issues. Prerequisite: consent of instructor or graduate status. One course. *Coie*



## COURSES CURRENTLY UNSCHEDULED

- 113. Research Methods in Psychology (B, C). (SS)
- 121. Health Psychology (P). (SS)
- 139. Psychobiology of Motivation (B, D). (NS)
- 147S. Experimental Social Psychology (P). (SS)
- 151S-152S. Child Clinical Psychology (D, P). (SS)
- 153S. Child Rearing: Theories, Research, Realities (D). (SS)
- 155S. Perinatal Behavior (B, D). (NS)
- 206S. Stress and Health (B, C). (SS)
- 231S. Parent-Child Interaction (D). (SS)
- 255S. Perinatal Behavior (B, D). (NS)
- 286S. Biological Basis of Hearing (B, C). (NS)

## THE MAJOR

### For the A.B. Degree

*Corequisites.* Corequisites are intended to place the study of psychology into a broad, liberal arts context. They are in four areas; *one* of a short list of courses is required in each area. (Note: the lists are updated regularly; inquire in the Undergraduate Studies Office).

(1) *Biological context of behavior.* Biology 14L or 22L.

(2) *Social context of behavior.* Biological Anthropology and Anatomy 93; Cultural Anthropology 94; Sociology 110.

(3) *History/philosophy of science.* Philosophy 104; Philosophy 110; Sociology 156; History 158.

(4) *Quantitative methods.* Mathematics 31 or equivalent.

*Required Courses.* Eight courses in psychology are required for the major, which is devised to provide depth and breadth, a small group course in psychology, and familiarity with the quantitative methods involved in psychology. For breadth, the student is required to take two *Introductory and Survey* courses including: (1) either 103 (Biological Bases of Behavior) or 107 (Cognitive Psychology), and (2) either 105 (Developmental Psychology) or 108 (Personality and Social Behavior). These *Introductory and Survey* courses define four areas of concentration in psychology as listed above. For depth, the student is required to take at least two courses in one of these areas in addition to the introductory course in that area of concentration. For instruction in small groups, the student is to take at least one seminar (number 140S and above, including 200-level courses). It is advisable that this seminar be in the student's area of concentration. For quantitative methods, the student is to take one of the following: Mathematics 136; Sociology 133; Statistics 200; or Psychology 117 (none of which count as one of the eight required courses in psychology). For purposes of the major, Sociology 106 is the equivalent of Psychology 116, and Sociology 133 is the equivalent of Psychology 117. A student guidebook describing the curriculum in detail is available from the Director of Undergraduate Studies.

### For the B.S. Degree

As for the A.B. degree, with the following additions: (1) Mathematics 32 or equivalent; (2) six courses in at least two of the following mathematics/natural science departments: mathematics (100-level or above, in addition to statistics requirement, above), computer sciences (100-level or above), chemistry, physics, and biology; (3) at least three of the six mathematics/natural science courses must be numbered 100 or higher; (4) at least one course that involves extensive laboratory or fieldwork (for example, experimental methods or independent research).

## Independent Study

A program of individualized readings or an empirical research project may be carried out by arrangement with a faculty supervisor and enrollment in Psychology 191-194. A written plan of the program must be approved by the supervisor and the Director of Undergraduate Studies. Credit for 191-194 may be recorded either as pass/fail or by means of letter grades. At most only one of these independent study courses may count toward the area of concentration requirement, and only two may count toward the major.

## Honors

Any student majoring in psychology with an overall grade point average of 3.3 and a grade point average of 3.3 in psychology courses may be a candidate for graduation with distinction in psychology. Recommendation for this honor is made by a faculty committee which evaluates a thesis submitted by the candidate and administers an oral examination. Candidates typically enroll in independent study courses (191-194) during one or more semesters, often as early as the junior year, although enrollment in independent study is not a precondition of candidacy. All eligible students are encouraged to carry out independent study and to secure the sponsorship of a faculty supervisor.

## Public Policy Studies (PPS)

Professor Cook, *Chairman*; Professor Kuniholm, *Director of Undergraduate Studies*; Professors Ascher, Barber (political science), Behn, Clotfelter, Fleishman (law), Gillis, Hough (political science), Ladd, Pearsall (engineering), and Price (political science); Associate Professors Conrad, Lipscomb, Magat (business), McConahay, Rapaport, and Stack; Assistant Professors Durning, Mayer, and Smith; Research Assistant Professors Entman and O'Neil; Professors of the Practice Broder, Geller, Harris, Kaiser, Stubbing, and Yaggy; Adjunct Professor Owen; Adjunct Lecturer Jackson; Visiting Professors Dupree, Friedrich-Cofer, and Healy; Visiting Associate Professor Dutton; Visiting Assistant Professors Malson and Newell; Instructors Braverman, Ott, and Storck; Lecturers Guillory, Pardue, and Payne; Visiting Lecturers Bredder, Slawson, and Stevens

A major is available in this department.

Courses in public policy are open to all students providing that any prerequisites are met.

**49S. Freshman Seminar.** Topics vary each semester offered. One course. *Staff*

**55. Analytical Methods for Public Policy-Making. (SS)** Basic concepts of analytical thinking including quantitative methods for assessing the probabilities of outcomes and appraising policy alternatives. Illustrated by problems faced by busy decision makers in government, business, law, medicine. One course. *Staff*

**107. Comparative Environmental Policies. (SS)** See C-L: Political Science 107; also C-L: Comparative Area Studies. One course. *McKean*

**110. Economic Analysis for Public Policy-Making: Microeconomic and Non-probabilistic Models. (SS)** Application of microeconomic analysis to public policy areas, including agriculture, housing, taxation, and income redistribution. (Not open to students who have taken Economics 149.) Prerequisite: Economics 52 or equivalent. One course. *Cook, Ladd, or Lipscomb*

**112. Statistics and Public Policy. (QR)** Uses and limitations of statistical methods, including experimentation, for monitoring and evaluating public policies. Not open to students who have taken Economics 138, Mathematics 117, Psychology 117, or Statistics 10. Prerequisite: Public Policy Studies 55. One course. *Cook or McConahay*

**114. Political Analysis for Public Policy-Making. (SS)** Analysis of the political and organizational processes which influence the formulation and implementation of public policy. Alternative models. C-L: Political Science 145. One course. *Durning, Mayer, or Smith*

**116. Policy Choice as Value Conflict. (SS)** Theoretical and practical problems in decision making in relation to conflicts of value and of interest. The manifestation of norms deriving from professional ethics, ideology, law, and other sources in such policy issues as welfare, environmental management, and national defense. One course. *Braverman, Kuniholm, Ott, Payne, or Rapaport*

**130S. Nongovernmental Organizations and Public Policy. (SS)** The consequences of the increasingly prominent role of nongovernmental organizations in public policy, including voluntary associations, cooperatives, self-help organizations, and public corporations. C-L: Political Science 130S. One course. *Smith*

**145D. Leadership, Policy, and Change. (SS)** Ethical and practical problems of leadership, including motivation, organizational morale, and strategies for large-scale change. Historical and modern case studies, literary examples, and political and psychological theory. One course. *O'Neil, Ott, or Payne*

**146S. Leadership and Judgment. (SS)** Theoretical and experiential foundation for the exercise of judgment and leadership in policy-making. Readings, in-class exercises, and a major leadership project within either the Duke or Durham community. Prerequisite: consent of instructor. One course. *Ott*

**151S. Administration of Justice. (SS)** Analysis of policy problems and conflicts involved in the operation of the criminal justice system. One course. *Staff*

**152S. Administration of Justice, Summer Internship. (SS)** Pass/fail grading only. Half course or one course. Prerequisite: Public Policy Studies 151S. Variable credit. *Staff*

**154S. Journalism and Public Policy. (SS)** Policy problems and conflicts involved in applying First Amendment principles to print and electronic journalism. Topics include libel, obscenity, privacy, national security, fair trial, and antitrust. One course. *Staff*

**155S. Journalism and Public Policy, Summer Internship. (SS)** Pass/fail grading only. Half course or one course. Prerequisite: Public Policy Studies 154S. Variable credit. *Broder and Kaiser*

**157S. Health Policy. (SS)** Analysis of health care problems and policies. One course. *Staff*

**158S. Health Policy, Summer Internship. (SS)** Pass/fail grading only. Half course or one course. Prerequisite: Public Policy Studies 157S. Variable credit. *Staff*

**159. State and Local Public Policy. (SS)** How state and local governments pay for public services. Financing education and transportation programs, the use of municipal bonds for capital projects, and the design of intergovernmental aid programs. State and local tax policy. Prerequisite: Public Policy Studies 110, Economics 149, or consent of instructor. C-L: Economics 159. One course. *Ladd*

**161S. State and Local Public Policy, Summer Internship. (SS)** Pass/fail grading only. Half course or one course. Prerequisite: Public Policy Studies 159S. Variable credit. *Staff*

**163S. Telecommunications Policy and Regulation. (SS)** Broadcast policies, the rise of cable television, spectrum allocation and authorization, and developments in common carrier telecommunications. One course. *Geller and staff*

**164S. Telecommunications Policy and Regulation, Summer Internship. (SS)** Pass/fail grading only. Half course or one course. Prerequisite: Public Policy Studies 163S. Variable credit. *Geller*



**167S. International Policy. (SS)** Relationships among organizations and agencies involved in international political and economic affairs, focusing on selected problems of international policy. Prerequisite: Political Science 93 or consent of instructor. One course. *Ascher, Kuniholm, or Mayer*

**168S. International Policy, Summer Internship. (SS)** Pass/fail grading only. Half course or one course. Prerequisite: Public Policy Studies 167S. Variable credit. *Storck*

**175S. The Palestine Problem and United States Public Policy. (CZ)** Identification of Arab and Zionist perceptions, alternatives available to American decision makers, interest group pressures on United States policies, historical analysis as a means to improve public policy. C-L: Comparative Area Studies and History 159S. One course. *Kuniholm*

**176S. American Communities: A Photographic Approach. (SS)** A documentary approach to the study of American communities through individual photographic projects centered around a community of the student's choosing. Prerequisite: consent of instructor. C-L: Film and Video. One course. *Harris*

**177S. Advanced Documentary Photography. (SS)** An advanced course for students who have taken Public Policy Studies 176S or have had substantial experience in documentary fieldwork. Students complete an individual photographic project and study important works within the documentary tradition. Prerequisite: Public Policy Studies 176S or consent of instructor. One course. *Harris*

**180S. Writing for the Media. (SS)** Workshop on writing news stories, editorials, and features for the print media. Prerequisite: consent of instructor. One course. *Staff*

**185. American Diplomacy from the Kennedy Administration to the Present. (SS)** C-L: History 185. One course. *C. Davis or Kuniholm*

**186S. Shaping the News. (SS)** C-L: Political Science 112S. One course. *Barber*

**188. The Psychology of Political Symbols. (SS)** See C-L: Political Science 188. One course. *McConahay*

**190. Internship.** For students working in a public agency, political campaign, or other policy-oriented group under the supervision of a faculty member. Pass/fail grading only. Prerequisites: prior consent of Assistant Director for Internships, Placement, and Alumni and Director of Undergraduate Studies. One course. *Staff*

**191, 192. Independent Study.** Directed reading and research. One course each. *Staff*

**193, 194. Independent Study.** Directed reading and research for seniors. One course each. *Staff*

**195S. Selected Public Policy Topics.** One course. *Staff*

### For Seniors and Graduates

**204S. Ethics in Political Life. (SS)** See C-L: Political Science 204S. One course. *Spragens*

**217. Microeconomics and Public Policy-Making. (SS)** Consumption and production theory, welfare economics, theories of collective choice, market structures and regulation, and nonmarket decision making. Not open to students who have taken Public Policy Studies 110. One course. *Clotfelter*

**218. Macroeconomic Policy. (SS)** Survey of macroeconomic theory and analysis of policies designed to reduce unemployment, stimulate economic growth, and stabilize prices. Conventional monetary and fiscal instruments, employment policies, and new policies designed to combat inflation. C-L: Economics 218. One course. *Staff*

**219. The Politics of the Policy Process. (SS)** The formulation of public policies, substantive policies in a variety of contexts from local government to international affairs; the

role of legislatures, interest groups, chief executives, and the bureaucracy in defining alternatives and in shaping policy from agenda formulation to implementation. Not open to students who have taken Public Policy Studies 114. C-L: Political Science 248. One course. *Mayer*

**221. Decision Analysis for Public Policymakers. (SS)** Methods for structuring decision dilemmas and decomposing complex problems, assessing the probabilities of uncertain consequences of alternative decisions, appraising the decision maker's preferences for these consequences and for reexamining the decision. Not open to students who have taken Public Policy Studies 55. One course. *Behn*

**222. Data Analysis for Public Policymakers. (QR)** Sampling theory, Bayesian statistics, and regression analysis. Examples from problems in health care, transportation, crime, urban affairs, and politics. Not open to students who have taken Public Policy Studies 112. One course. *McConahay*

**223. Ethics and Policy-Making. (SS)** Normative concepts in politics, liberty, justice, and the public interest: historical and philosophical roots, relationship to one another and to American political tradition, and implications for domestic and international problems. Not open to students who have taken Public Policy Studies 116. C-L: Political Science 245. One course. *Rapaport*

**231. Quantitative Evaluation Methods. (QR)** Problems in quantifying policy target variables such as unemployment, crime, and poverty. Experimental and nonexperimental methods for evaluating the effect of public programs, including topics in experimental design, regression analysis, and simulation. Prerequisite: Public Policy Studies 222 or equivalent. One course. *Cook or McConahay*

**232. Microeconomics: Policy Applications. (SS)** Cost benefit analysis of public programs. Public utility regulation, pollution regulation, hospital rate setting, regulation of product safety. Quantitative methods and microeconomic theory for analysis of both normative and positive aspects of economic policy. Prerequisites: Public Policy Studies 110 or 217 or Economics 149 and familiarity with regression analysis or concurrent enrollment in Public Policy Studies 231. C-L: Economics 232. One course. *Ladd*

**236S, 237S. Public Management I and II: Managing Public Agencies. (SS)** 236S: operations management, information and performance, personnel management, public sector marketing. 237S: organizational strategy, organizational structure and design, leadership and motivation, labor negotiations. Prerequisite: for 237S, Public Policy Studies 236S. One course each. *Behn or Yaggy*

**238S. Public Budgeting and Financial Management. (SS)** Fund accounting for government; techniques of financial analysis, including break-even analysis, cost accounting, cash-flow analysis, and capital budgeting; and governmental budgeting, including the budgetary process and reforms, and the budget crunch in the public sector. One course. *Stubbing*

**240S. Analyzing the News. (SS)** Research seminar on political messages and effects of media. Methods and findings of content analysis, survey research, critical theory, semiology; research project integrating these approaches. C-L: Political Science 208S. One course. *Staff*

**245S. Leadership Tutorial. (SS)** Analysis of techniques, personal qualities, and organizational factors that help or hinder effective leadership. Practical experience in evaluation of leadership efforts. Prerequisite: Public Policy Studies 145D or consent of instructor. One course. *Payne*

**250S. Policy, Philanthropy, and the Arts. (SS)** Democratic and aesthetic values in relation to past and present patterns of public, corporate, and philanthropic support for

the arts. The uses of art criticism and political theory in evaluating subsidies, grants, tax incentives, and censorship. One course. *Payne*

**254. Transportation Planning and Policy Analysis. (SS)** Prerequisite or corequisite: Civil and Environmental Engineering 116 or consent of instructor. See C-L: Civil and Environmental Engineering 216. One course. *Pas*

**257. United States Policy in the Middle East. (SS)** From World War II to the present with a focus on current policy options. C-L: Comparative Area Studies. One course. *Kuniholm*

**264S. Research Seminar: Topics in Public Policy I. (SS)** Selected topics. One course. *Staff*

**267S. Policy-Making in International Organizations. (SS)** Emphasis on international financial institutions such as the World Bank and the International Monetary Fund. C-L: Political Science 267S. One course. *Ascher*

**268. Federal Tax Policy. (SS)** Structure, incidence, and economic effects of major federal taxes. Special attention to problems of inflation, income definition, distortions, savings, and investment. C-L: Economics 268. One course. *Clotfelter or Schmalbeck*

**272. Resource Economics and Policy. (SS)** Prerequisite: introductory course in economics or consent of instructor. C-L: Forestry and Environmental Studies 270. One course. *Hyde*

**278. Human Service Bureaucracies. (SS)** Schools, prisons, courts, welfare agencies: decision making, implementation, the impact of work practices on clients. The future of street-level bureaucracy. One course. *Stack*

**283S. Congressional Policy-Making. (SS)** See C-L: Political Science 283S. One course. *Bianco or Canon*

**284S. Public Policy Process in Developing Countries. (SS)** Policy-making patterns in less developed countries; examples from Latin America, Africa, and Asia. C-L: Comparative Area Studies and Political Science 284S. One course. *Ascher*

**286S. Economic Policy-Making in Developing Countries. (SS)** Fiscal, monetary, and exchange rate policies in less developed countries; issues in public policy toward natural resources and state-owned enterprises. Prerequisite: Public Policy Studies 110 or Economics 149. C-L: Comparative Area Studies and Economics 286S. One course. *Conrad or Gillis*

**290. Glasgow Seminar in Public Policy. (SS)** The large theoretical problems of public policy (for example, justice, equality, liberty); the making and implementation of policy in specific areas (for example, economic, urban, social); comparative analysis of Europe's communist countries and how their political systems differ from those of the United States and Britain. (Taught in Scotland.) Prerequisites: Public Policy Studies 55, 110, 112, 114, 116, and consent of Director of Undergraduate Studies, who may waive requirements. One course. *Staff*

#### COURSES CURRENTLY UNSCHEDULED

**118S. Ethical Dilemmas and Social Policy. (SS)**

**166. Child Policy in the United States. (SS)**

**178S. Visual Language and Policy Choice. (SS)**

**241. Reporting the American People. (SS)**

**256. The Economics of Health Care. (SS)**

**270S. Humanistic Perspectives on Public Policy. (SS)**



## INTERNSHIP COURSES

The internship courses provide students with an opportunity to develop a basic understanding of one or more public policy areas, to apply that understanding in a job during the summer, and to return to the classroom to build on this knowledge and experience. Normally, students take a two-course sequence to receive credit for the field experience requirement of all public policy studies majors. Prior to participation in the internship program, all majors must have completed Public Policy Studies 55 and three of the four core courses (Public Policy Studies 110, 112, 114, or 116). This requirement may be waived by the Director of Undergraduate Studies for transfer students or others in unusual circumstances. Applications for enrollment in the internship program must be completed in the early fall and approved by the Assistant Director of Internships, Placement, and Alumni. Stipends are usually provided for all public policy majors enrolled in an internship sequence that begins with any one of the following internship courses: Public Policy Studies 152S, 155S, 158S, 161S, 164S, or 168S.

All majors are encouraged to take an advanced follow-up course in the area of their summer internship.

## THE MAJOR

The public policy studies major is an interdisciplinary social science program designed to provide students with the skills, analytical perspectives, and descriptive information needed by policy analysts to deal effectively with major contemporary social problems. The course of study familiarizes the student with the kind of contribution each of several disciplines (political science, economics, social psychology, applied mathematics, history, and ethics) can make to policy analysis. Opportunities are provided, both in the classroom and through field experiences, for students to integrate this material and apply it to analyzing specific public policy issues.

Students majoring in public policy participate in a variety of learning experiences including seminars, lecture and discussion classes, individual study, policy workshops, and an internship. In addition, students are urged to participate actively in programs sponsored by the Institute of Policy Sciences and Public Affairs to supplement material covered in class. As a matter of policy, students are asked to evaluate teaching and course content and are provided both formal and informal opportunities to shape the program and curriculum.

*Prerequisites.* Economics 2 or 52, Political Science 91, and Public Policy Studies 55.

*Major Requirements.* Public Policy Studies 110, 112, 114, 116, plus three additional courses, one of which must be a 200-level course. A policy-oriented field experience approved by the Assistant Director of Internships, Placement, and Alumni is required. (See Internship Courses above.)

## Religion (REL)

Professor Hillerbrand, *Chairman*; Associate Professor Surin, *Director of Undergraduate Studies*; Professors Clark, Kort, Lawrence, Lincoln, E. Meyers, Osborn, and Wintermute; Associate Professors Bland, Corless, McCollough, C. Meyers, Partin, and Peters; Assistant Professors Martin and Robinson; Lecturer Shows

A major is available in this department.

Study in the Department of Religion arises from the recognition that religion, although it takes many forms, is a constitutive element of human existence individually and collectively. The curriculum pursues the study of religion in two distinguishable ways: first, through the examination of the particulars of specific religious traditions; and, second, through theoretical studies of an analytic, comparative, and constructive nature.

Introductory courses (Religion 50, 51, 52, 53, 54, 55, 56, 57, 58, and 59) are open to all undergraduates. These courses also help fulfill distributional field requirements for the

religion major. Courses at the 100 level are open to all undergraduates with the exception of those specially designated. Courses at the 200 level are open to upperclassmen with the consent of the instructor.

**49S. Freshman Seminar.** Topics vary each semester offered. One course. *Staff*

**50. The Old Testament. (CZ)** Historical, literary, and theological investigations. C-L: Judaic Studies. One course. *C. Meyers, E. Meyers, Peters, or Wintermute*

**51. Introduction to Judaic Civilization. (CZ)** Continuity and change in the major periods of Judaism. C-L: Judaic Studies. One course. *Bland or E. Meyers*

**52. The New Testament. (CZ)** Origins, development, and content of thought. One course. *Martin or staff*

**52D. The New Testament. (CZ)** Same as Religion 52 with discussion section included. One course. *Staff*

**53. The Roman Catholic Tradition. (CZ)** A survey of the development of Roman Catholic theology and institutions from the second century to Vatican II. One course. *Clark*

**54. Protestant Traditions. (CZ)** A survey of the historical development of Protestant theologies and denominations. One course. *Clark*

**55. Biblical Literature. (AL)** A study of selected Old Testament and New Testament texts, their cultural context, and the relation within them of religious meaning to literary form. One course. *Staff*

**56. The Black Religious Experience in America. (CZ)** From the slave period to the present. C-L: Afro-American Studies 56. One course. *Lincoln*

**57. Introduction to Religions of Asia. (CZ)** Problems and methods in the study of religion, followed by a survey of the historical development, beliefs, practices, and contemporary significance of the Islamic religion and religions of south and east Asia. C-L: Comparative Area Studies. One course. *Corless, Lawrence, Partin, or Robinson*

**58. Interpretations of Religion in Western Culture. (CZ)** Western religion as explained by contemporary sociologists, psychologists, anthropologists, and theologians. One course. *Bland or staff*

**59. An Introduction to Christian Theology and Ethics. (CZ)** Analysis and interpretation of faith and practice. One course. *Kort, McCollough, or Osborn*

**60. Ethical Issues in Twentieth-Century America. (CZ)** A critical examination of ethical themes, with special emphasis on public policy. For participants in the Twentieth-Century America Semester only. One course. *McCollough*

**71A, 72A. Freshman-Sophomore Seminars: African and Asian Traditions.** Topics and instructors to be announced. One course each. *Staff*

**71C, 72C. Freshman-Sophomore Seminars: Analytic, Comparative, and Constructive Studies.** Topics and instructors to be announced. One course each. *Staff*

**101. Selected Studies in the Bible: Prophets. (CZ)** Analysis and interpretation of representative issues and personalities in the historical and prophetic books. C-L: Judaic Studies. One course. *Staff*

**102. Selected Studies in the Bible: Writings. (CZ)** Analysis and interpretation of representative forms and ideas, with particular attention to wisdom literature and psalms. C-L: Judaic Studies. One course. *Staff*

**105. Theology of the Old Testament. (CZ)** Emphasis upon history and eschatology, covenant, messianism, and wisdom. C-L: Judaic Studies. One course. *Wintermute*

**106. Jesus and the Synoptic Gospels. (CZ)** The gospel tradition in the New Testament. One course. *Staff*

**108. The Life and Letters of Paul. (CZ)** Paul's role in the expansion of the Christian movement, the most important aspects of his thought, and his continuing influence. One course. *Martin*

**109. Women in the Biblical Tradition: Image and Role. (CZ)** C-L: Judaic Studies and Women's Studies. One course. *C. Meyers*

**110. Archaeology and Art of the Biblical World. (CZ)** The material culture of ancient Palestine as it relates to the Hebrew Bible, the New Testament, and early Judaism. C-L: Comparative Area Studies. One course. *C. Meyers or E. Meyers*

**111. The Historical Jesus. (CZ)** Historical research on the life of Jesus. One course. *Martin*

**115-116. Introduction to Biblical Hebrew. (FL)** (Divinity School courses open to undergraduates with consent of instructor.) Elements of phonology, morphology, and syntax. Exercises in reading and writing Hebrew. 116: study of the weak verb; exegetical treatment of the Book of Jonah. C-L: Judaic Studies. Two courses. *Bailey*

**120. History of the Christian Church. (CZ)** Crucial events, issues, structures, and writings that have shaped the Christian community and influenced Western civilization from the time of the Early Church to the present. One course. *Hillerbrand*

**123. Issues in Early Christian History. (CZ)** Theological, ecclesiastical, moral, and social issues in second- to fifth-century Christianity. Prerequisite: Religion 52 or 53 or 54 or 125 or consent of instructor. One course. *Clark*

**125. Women and Sexuality in the Christian Tradition. (CZ)** A historical survey of Christian attitudes and practices from New Testament times to the present. C-L: Comparative Area Studies and Women's Studies. One course. *Clark*

**128. The Background of Contemporary Christian Thought: 1918-1960. (CZ)** Theology of Karl Barth, Rudolf Bultmann, Paul Tillich, Karl Rahner, Reinhold Niebuhr, and others. One course. *Osborn*

**129. Contemporary Christian Faith and Politics. (CZ)** One course. *Osborn*

**131D. Principles of Archaeological Investigation. (CZ)** Supervised fieldwork, visits to other excavations, introduction to ceramic chronology, numismatics, and other related disciplines. Excavation of a late Roman village in Galilee. Offered in Israel, only in the summer. C-L: Judaic Studies. One course. *C. Meyers or E. Meyers*

**132D. Palestine in Late Antiquity. (CZ)** The history, literature, and archaeology of Roman Palestine with particular emphasis on Galilee in rabbinic and early Christian times. C-L: Judaic Studies. One course. *E. Meyers*

**133. The Foundations of Post-Biblical Judaism. (CZ)** History, religion, and literature of Pharasaic and sectarian Judaism from the time of Ezra to Rabbi Judah. C-L: Judaic Studies. One course. *E. Meyers*

**134. Jewish Mysticism. (CZ)** The main historical stages, personalities, texts, and doctrines from rabbinic to modern times. C-L: Comparative Area Studies, Judaic Studies, and Medieval and Renaissance Studies. One course. *Bland*

**135. Jewish Religious Thought. (CZ)** Doctrines, dialectics, and religious attitudes of pre-Enlightenment theologians. C-L: Comparative Area Studies, Judaic Studies, and Medieval and Renaissance Studies. One course. *Bland*



**136. Contemporary Jewish Thought. (CZ)** Modern Jewish thought from Mendelssohn to the present, with particular reference to American thinkers. C-L: Comparative Area Studies and Judaic Studies. One course. *Bland or E. Meyers*

**138. Political Leadership in the Black Church. (SS)** Turner, Powell, King, Malcolm X, and others. C-L: Afro-American Studies 138. One course. *Lincoln*

**140. Religions of India. (CZ)** Major religious traditions of the subcontinent: Hinduism, Buddhism, Jainism, and Islam. C-L: Comparative Area Studies. One course. *Lawrence or staff*

**141. Religions of China and Japan. (CZ)** Traditional religion in China and Japan and its interaction with Sino-Japanese Buddhism. C-L: Comparative Area Studies. One course. *Corless*

**142. Comparative Mythology. (CZ)** Nature and functions of religious myth in Judaism, Christianity, Islam, Hinduism, and Buddhism. C-L: Comparative Area Studies. One course. *Partin*

**143. Mysticism. (CZ)** The mystical element of religion: Hinduism, Buddhism, Christianity, and Islam. C-L: Comparative Area Studies. One course. *Staff*

**144. Black Cults and Sects in America. (SS)** Cult-sect phenomena. C-L: Afro-American Studies 144. One course. *Lincoln*

**145. Social Issues in Contemporary Hinduism. (CZ)** Emphasis on the caste system and reactions to it; topics include untouchability, religious roles of women, and institutional responses to famines and epidemics. C-L: Comparative Area Studies. One course. *Robinson*

**148. Modern American Religious Cults. (CZ)** Children of God, Unification Church, Scientology, Feraferia, Transcendental Meditation, Krishna Consciousness, Bahai, and others. One course. *Partin*

**149. Buddha and Buddhism. (CZ)** A systematic introduction to the origins and spread of Buddhist thought and practice. C-L: Comparative Area Studies. One course. *Corless*

**151. Ethical Issues in Social Change and Public Policy. (CZ)** American moral tradition and factors in social change in the normative analysis of public policy, with a consideration of specific ethical issues. One course. *McCullough*

**152. Islamic Mysticism. (CZ)** Sufism as an ascetical protest movement that affected the worldwide growth of Islam. C-L: Comparative Area Studies. One course. *Lawrence*

**155. Ethical Issues in the Life Cycle. (CZ)** Human development viewed in religious, ethical, and psychological perspectives. One course. *McCullough*

**157. Bioethics in Comparative Contexts. (CZ)** Ethical approaches to health and illness from moral, religious, and philosophical perspectives in relation to economic, social, and political factors. C-L: Comparative Area Studies. One course. *McCullough*

**158. Psychology and Religion. (SS)** Contributions of major psychological theories to an understanding of religion, especially Christianity. One course. *Shows*

**159. Ethical Issues in Health Care. (CZ)** A theological and comparative study of selected ethical issues in health policy: the profession of medicine, institutional organization and services, and medical practice. One course. *McCullough*

**162, 163. Introduction to Islamic Civilization. (CZ)** See C-L: Interdisciplinary Course 162, 163; also C-L: Comparative Area Studies; Cultural Anthropology 147, 148; History 101G, 102G; and Medieval and Renaissance Studies. One course each. *Lawrence and staff*

**164. History and Religions of North Africa. (CZ)** An introduction to the cultural patterns, social forces, and historical developments that have shaped North Africa and its major religious traditions. C-L: History 187 and Interdisciplinary Course 164. One course. *Lawrence*

**170. Problems of Religious Thought. (CZ)** Analysis of uses of *know, true, mind, body, time, person, love, meaning*, in modern Western culture as introduction to religious reflection. One course. *Staff*

**172. Religion and Tragedy. (AL)** Influence of the Judaic-Christian religious tradition on the development of the tragic view of life. One course. *Staff*

**174. Technology Assessment and Social Choice. (CZ)** See C-L: Engineering 174. One course. *Garg and McCollough*

**186. Faith and Fiction in Victorian England. (AL)** The relation of fiction to major religious and theological developments in England during the Victorian period. (Summer program in England.) Not open to students who have taken English 137. C-L: English 132. One course. *Staff*

**187. Atmosphere and Mystery in Twentieth-Century English Fiction. (AL)** Narrative atmosphere in English fiction of this century in relation to beliefs about circumstances which limit and determine the human world; religious significance of these beliefs. (Summer program in England.) One course. *Kort*

**188. Recent Literature and Its Religious Implications. (AL)** Religious elements in recent literature. One course. *Kort*

**191, 192. Independent Study.** For freshmen and sophomores with departmental approval. One course each. *Staff*

**193, 194. Independent Study.** For juniors and seniors with departmental approval. One course each. *Staff*

**195A, 196A. Junior-Senior Seminars: African and Asian Traditions.** Topics and instructors to be announced. One course each. *Staff*

**195B, 196B. Junior-Senior Seminars: Jewish and Christian Traditions.** Topics and instructors to be announced. C-L: Judaic Studies. One course each. *Staff*

**195C, 196C. Junior-Senior Seminars: Analytic, Comparative, and Constructive Studies.** Topics and instructors to be announced. One course each. *Staff*

**197-198. Honors Research.** Consent of the Director of Undergraduate Studies required. Two courses. *Staff*

### **For Seniors and Graduates**

**207, 208. Intermediate Biblical Hebrew. (FL)** Grammar with reading and exegesis of Old Testament prose and poetry. Prerequisite: at least one year of Hebrew or consent of instructor. C-L: Old Testament 207, 208 and Judaic Studies. One course each. *Staff*

**212. Policy-Making and Theological Ethics. (CZ)** Relation of knowledge, power, and values in policy-making; models of decision making in the policy sciences and their ethical implications. One course. *McCollough*

**217. Islam in India. (CZ)** History and thought of major Indian Muslims from Biruni to Wali-Ullah, with special attention to the role of Sufism. An introduction to selected Muslim scholars and saints who contributed to the interaction between Islam and Hinduism in Northern India during the second millenium A.D. C-L: Comparative Area Studies. One course. *Lawrence*

**218. Religions of East Asia. (CZ)** Shinto, Taoism, Confucianism, and East Asian Buddhism studied phenomenologically in relation to the Axial Age. One course. *Corless*

**220. Rabbinic Hebrew. (FL)** Interpretive study of late Hebrew, with readings from the Mishnah and Jewish liturgy. C-L: Judaic Studies. One course. *E. Meyers or staff*

**221. Readings in Hebrew Biblical Commentaries. (CZ)** Selected Hebrew texts in Midrash Aggadah and other Hebrew commentaries reflecting major trends of classical Jewish exegesis. C-L: Judaic Studies. One course. *Bland*

**226B. Exegesis of the Greek New Testament (Romans). (CZ)** Prerequisite: consent of instructor. One course. *Staff*

**226F. Exegesis of the Greek New Testament (I and II Corinthians). (CZ)** Prerequisite: consent of instructor. One course. *Staff*

**228. Twentieth-Century Continental Theology. (CZ)** An investigation of leading theologians and theological trends. One course. *Osborn*

**230S. The Meaning of Religious Language. (CZ)** An analysis of the credentials of some typical claims of theism in the light of theories of meaning in recent thought. Prerequisite: consent of instructor. C-L: Philosophy 230S. One course. *Staff*

**231S. Seminar in Religion and Contemporary Thought. (CZ)** Analytical reading and discussion of such critical cultural analysis as is found in the works of Polanyi, Arendt, Trilling, and others, with appraisal of the relevance of theological inquiry. One course. *Staff*

**232S. Religion and Literature. (AL)** Theories concerning the relation of religion to literary forms, particularly narrative. One course. *Kort*

**233. Modern Narratives and Religious Meanings. (AL)** A study of kinds of religious meaning or significance in representative American, British, and continental fiction of the first half of the twentieth century. One course. *Kort*

**234. Early Christian Asceticism. (CZ)** The development of asceticism and monasticism in the first six centuries of Christianity. C-L: Women's Studies. One course. *Clark*

**235. Heresy: Theological and Social Dimensions of Early Christian Dissent. (CZ)** One course. *Clark*

**238. Jewish Responses to Christianity. (CZ)** Apologetic and polemical themes in rabbinic, medieval, and contemporary writings. C-L: Judaic Studies. One course. *Bland*

**239. Introduction to Middle Egyptian I. (FL)** Grammar and readings in hieroglyphic texts relating to the Old Testament. One course. *Wintermute*

**240. Introduction to Middle Egyptian II. (FL)** Readings in Middle Egyptian and introduction to New Egyptian Grammar. Prerequisite: Religion 239. One course. *Wintermute*

**243. Archaeology of Palestine in Biblical Times. (CZ)** Investigation of selected material remains from the Bronze Age to the Persian period. Trends in biblical studies, with particular attention to methodological considerations and current developments. One course. *C. Meyers*

**244. The Archaeology of Palestine in Hellenistic-Roman Times. (CZ)** The study of material and epigraphic remains as they relate to Judaism in Hellenistic-Roman times, with special emphasis on Jewish Art. C-L: Judaic Studies. One course. *E. Meyers*

**248. Theology of Karl Barth. (CZ)** A historical and critical study of Barth's theology. One course. *Osborn*

**258. Coptic. (FL)** Introduction to the Sahidic dialect with selected readings from Christian and Gnostic texts. Prerequisite: one year of Greek or consent of instructor. One course. *Wintermute*



**264. The Sociology of the Black Church. (SS)** An effort to identify, define, describe, and interpret the black church. One course. *Lincoln*

**265. Religions of the West Africa Diaspora. (CZ)** Religious development of Africans displaced to the Western Hemisphere by slavery. C-L: Afro-American Studies 265 and Comparative Area Studies. One course. *Lincoln*

**269S. Feminist Theory and the Humanities.** See C-L: Interdisciplinary Course 283S; also C-L: English 283S and Women's Studies. One course. *Clark, Orr, Pope, Sedgwick, or Tompkins*

**280. The History of the History of Religions. (CZ)** The origin and history of the comparative study of religion, with particular attention to its methodology. One course. *Partin*

**282. Myth and Ritual. (CZ)** Myths, rites, and symbols as modes of religious expression. Interpretation of symbolic configurations of kingship, initiation, sacrifice, and pilgrimage in diverse cultural contexts. C-L: Comparative Area Studies. One course. *Robinson and staff*

**283. Islam and Modernism. (CZ)** Cultural, religious, and ideological forces which shape Muslim responses to modernism. C-L: Comparative Area Studies. One course. *Lawrence*

**285. Introduction to the History of Religions. (CZ)** The history, symbols, rites, and structures of the manifestations of the sacred in the major religious traditions of the world. One course. *Staff*

**287. The Scriptures of Asia. (CZ)** Translations of basic texts from the religious traditions of India, China, and Japan. C-L: Comparative Area Studies. One course. *Staff*

**297. Philosophical and Theological Discourses on Modernity. (CZ)** Theological responses to the intellectual and cultural agendas set by the Enlightenment. One course. *Surin*

**298. Religious Pluralism and Christian Theologies. (CZ)** The ascription of superiority or uniqueness to particular religions within the context of the world religions. The phenomenon of religious pluralism will provide a thematic focus for this study. One course. *Surin*

## COURSES CURRENTLY UNSCHEDULED

71B, 72B. Freshman-Sophomore Seminars: Jewish and Christian Traditions

99. Perspectives in Archaeology. (CZ)

100. Selected Studies in the Bible: Pentateuch. (CZ)

107. Theology of the New Testament. (AL)

124. Christianity in the United States. (CZ)

147. Muhammad and the Qur'ān. (CZ)

160, 161. Introduction to the Civilizations of Southern Asia. (CZ)

166. The Professions and Society. (SS)

281. Phenomenology and Religion. (CZ)

284. The Religion and History of Islam. (CZ)

288. Buddhist Thought and Practice. (CZ)

## RELIGION COURSES BY FIELDS

**Introductory Courses.** Religion 50, 51, 52, 52D, 53, 54, 55, 56, 57, 58, 59, 60.

**African and Asian Religions.** Religion 57, 71A, 72A, 140, 141, 145, 147, 149, 152, 160, 161, 162, 163, 195A, 196A, 217, 255, 265, 283, 284, 285, 287.

**Jewish and Christian Traditions.** Religion 50, 51, 52, 52D, 55, 71B, 72B, 100, 101, 102, 105, 106, 107, 108, 109, 110, 111, 115-116, 120, 123, 124, 125, 127, 128, 129, 131D, 132D, 134, 135, 139, 195B, 196B, 207, 208, 220, 221, 226B, 228, 239, 243, 248, 258.

**Analytic, Comparative, and Constructive Studies.** Religion 56, 58, 59, 60, 71C, 72C, 99, 138, 142, 143, 144, 148, 151, 155, 158, 166, 170, 172, 174, 188, 195C, 196C, 212, 233, 238, 264, 280.

## THE MAJOR

*Major Requirements.* Eight courses, which must include at least two introductory courses (numbered 50 through 60). The distribution of courses must also include at least one each from the categories African and Asian traditions; Jewish and Christian traditions; and analytic, comparative, and constructive studies. One of the eight courses must be a junior-senior seminar or a 200-level course.

The student, in consultation with an assigned advisor and with the advisor's approval, should elect four of the eight courses in such a way that they constitute a thematic or methodological concentration on a particular aspect of religion.

To prepare for graduate or professional study of religion, the department recommends that students complete at least four courses in college level study, or the equivalent, of a foreign language. Master of Arts and Doctor of Philosophy programs often require examination in one or two foreign languages. Students planning to attend a theological seminary should note that knowledge of biblical languages, as well as Latin, frequently is presupposed or required. Those planning to pursue studies of Asian religions should begin appropriate language study as part of their undergraduate preparation.

*Honors.* The department offers work leading to graduation with distinction. For further information consult the Director of Undergraduate Studies and the section on honors in this bulletin.

## Romance Studies (RS)\*

Professor Pérez Firmat, *Chairman*; Assistant Professor Bell, *Director of Undergraduate Studies*; Professors Fein, Garci-Gómez, Jameson, Mudimbe, Osuna, Schor, Stewart, Tetel, and Thomas; Associate Professors Bryan, Caserta, Kaplan, and Orr; Assistant Professors Farrell, Finucci, Ross, Sieburth, and Solterer; Professors Emeriti Cordle, N. Dow, Fowlie, Jordan, and Wardropper; Associate Professors Emeriti Ripley and Vincent; Assistant Professors Emeriti M. T. Dow and Miller; Adjunct Associate Professor Keinig; Visiting Assistant Professor Mudimbe-Boyi; Lecturer and Coordinator of Language Instruction Tufts

Majors in French and Spanish are available in this department.

French and Spanish 76, or an Achievement or Placement Test score of 600 in French and 630 in Spanish, are the prerequisites for all courses over 100 not taught in English. Students who by reason of foreign residence have had special opportunities in French or Spanish must be classified by the Director of Undergraduate Studies.

The intensive language courses 181 and 182 provide an introduction to the language. They are recommended for students who wish to acquire proficiency in a second foreign language before entering graduate school.

In literature, one credit is granted for a score of 3 or 4 and two credits for a score of 5 (French or Spanish 70, 71) on the examination of the advanced placement program. In language, one advanced placement credit (French or Spanish 76) is granted for scores of 4 and 5.

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\*Proposed title at time the bulletin went to press.

## FRENCH (FR)

**1-2. Elementary French. (FL)** Understanding, speaking, reading, and writing French. Language laboratory for recording-listening practice. Two courses. *Staff*

**12. Review of Elementary French. (FL)** Intensive review of first-year French. Open only to students with a placement or achievement score of 380-440. May not be taken for credit by students who have taken 1-2. One course. *Staff*

**49S. Freshman Seminar.** Topics vary each semester offered. One course. *Staff*

**63. Intermediate French. (FL)** Grammar review, reading, and oral practice, including laboratory experience. Prerequisite: French 2, 12, or Achievement or Placement Test score of 450-540. One course. *Staff*

**70, 71. Introduction to Literature.** These numbers represent one or two course credits for advanced placement in literature. One course each.

**76. Advanced Intermediate French. (FL)** Oral practice, reading, composition. Prerequisite: French 63 or Achievement or Placement Test score of 550-590. One course. *Staff*

**101, 102. Introduction to French Literature. (AL, FL)** An introduction to the major writers of the French literary tradition. Selections and complete works of poetry, fiction, theater, and essay. 101: Middle Ages through the eighteenth century. 102: nineteenth and twentieth centuries. Lectures and discussions; short essays and tests. Conducted in French. One course each. *Staff*

**103S, 104S. Discussions of Readings. (AL, FL)** Selected topics. Open only to freshmen and sophomores. One course each. *Staff*

**107S. Contemporary Ideas. (CZ, FL)** Readings and discussion of French works which have provoked political or intellectual thought in recent years. For freshmen and sophomores only. C-L: Comparative Area Studies. One course. *Staff*

**108S. French Women: Myths, Realities, and the Law. (CZ, FL)** Influential women writers of the last forty years: Beauvoir, Duras, Yourcenar, Sullerot, Veil, Halimi, and others. C-L: Women's Studies. One course. *Bryan*

**110. Advanced Grammar and Composition. (FL)** A systematic study of the structure of formal French. Practice in writing. One course. *Bryan or Hull*

**111S. French for Current Affairs. (FL)** Problems and controversies in today's France. Readings, discussions, and exposés. One course. *Bryan or Keinig and staff*

**112S. Special Topics in Advanced Language. (FL)** Intensive work on the vocabulary and usage of a specialized field. Readings, discussions, and exposés. One course. *Staff*

**113S. French for Business and Law. (FL)** An introduction to French commercial and legal practices and vocabulary. C-L: Comparative Area Studies. One course. *Bryan*

**117. French Phonetics. (FL)** Sounds, rhythm, intonation. Individual practice in language laboratory. Readings in phonetic theory. One course. *Hull*

**118. Advanced Translation and Stylistics. (FL)** Differences between French and English patterns of expression. Levels of usage. Practice in translation. Prerequisite: French 110 or equivalent or consent of instructor. One course. *Hull or Thomas*

**131S. French in the New World. (FL, SS)** French and Creole in Canada, New England, Louisiana, and the Caribbean. Origins, history, linguistic characteristics, current political and social issues. C-L: Canadian Studies, Comparative Area Studies, and Linguistics. One course. *Hull*



**136S. Life in Eighteenth-Century France. (CZ, FL)** A course based on period documents—books, memoirs, newspapers, scandal sheets—designed to give a picture of life in a large French city before the modern era. C-L: Comparative Area Studies. One course. *Stewart*

**137. Aspects of Contemporary French Culture. (CZ, FL)** Offered only as part of summer program in Paris. C-L: Comparative Area Studies. One course. *Staff*

**139. French Civilization. (CZ, FL)** The institutions and culture of France from the Middle Ages to the present. Readings and discussions in French. C-L: Comparative Area Studies. One course. *Keinig or Tetel*

**141S, 142S. French Literature. (AL, FL)** Topics to be announced. Open to juniors and seniors. One course each. *Staff*

**143. Aspects of French Literature. (AL, FL)** Concentration on single authors, genres, movements, or themes. Topics to be announced. Offered only as part of summer program in Paris. One course. *Staff*

**145S. Topics in Renaissance Literature and Culture. (AL, FL)** Topics may include: women writers, love and self-knowledge, carnival and the grotesque, in search of Rome, text as political and religious pamphlet. C-L: Medieval and Renaissance Studies. One course. *Tetel*

**146S. Montaigne and Self-Portraiture. (AL, FL)** A reading of some *essais* in the light of the self-portrait in Renaissance art. C-L: Medieval and Renaissance Studies. One course. *Tetel*

**147. The Roots of Modernity in Seventeenth-Century Literature. (AL, FL)** Analysis of form and thought in selected works of Descartes, La Fontaine, Madame de Lafayette, Pascal, La Rochefoucauld, and La Bruyère. Emphasis on the innovations and lasting influence of each author. One course. *Farrell*

**148. French Drama of the Seventeenth Century. (AL, FL)** The plays of Corneille, Racine, and Molière read in conjunction with several twentieth-century works to explore dramatic conventions and the difference between tragedy and comedy. C-L: Drama 126 and Medieval and Renaissance Studies. One course. *Farrell*

**151. French Comedy. (AL, FL)** The theatrical tradition of comedy and its evolution, with emphasis on Molière, Marivaux, and Beaumarchais, and other readings from *Pathelin* to Ionesco. C-L: Drama 122. One course. *Stewart*

**152. The Early French Novel. (AL, FL)** Origins and evolution of the novel in the seventeenth and eighteenth centuries: Madame de Lafayette, Marivaux, Prévost, Rousseau, Diderot, Laclos, Sade. One course. *Stewart*

**153. The French Enlightenment. (AL, FL)** Religion, politics, and philosophic and literary ideas of eighteenth-century France: Montesquieu, Voltaire, Rousseau, and others. One course. *Stewart*

**155. Romanticism in French Literature. (AL, FL)** Romantic theory and practice; including Constant, Chateaubriand, Lamartine, Hugo, Musset, Vigny, and Nerval. One course. *Orr*

**156. The Age of the Novel. (AL, FL)** Flaubert, Balzac, and Stendhal. One course. *Bell, Orr, or Schor*

**157. Difference and Representation. (AL, FL)** Issues of gender and representation in nineteenth-century French fiction and painting. One course. *Schor*

**158. Toward Modernism in French Poetry. (AL, FL)** An introduction to modern trends in the nineteenth century; emergence from traditional romanticism; art for art's sake and

Parnassians (Gautier, Leconte de Lisle); the transition from decadence to symbolism (Baudelaire, Verlaine, Rimbaud, and Mallarmé). One course. *Thomas*

**159. Feminist Fiction.** (AL, FL) Works by women in the modern period, including George Sand, Colette, Simone de Beauvoir, and others. C-L: Women's Studies. One course. *Orr*

**162. French Drama of the Twentieth Century.** (AL, FL) A survey of literature for the stage from 1890 to the present. One play each of Claudel, Maeterlinck, Jarry, Giraudoux, Cocteau, Ghelderode, Anouilh, Montherlant, Sartre, Camus, Genet, Ionesco, Beckett, Pinget, Vian, and Arrabal. C-L: Drama 123. One course. *Staff*

**163. French Poetry of the Twentieth Century.** (AL, FL) The symbolist heritage and surrealism: Mallarmé, Apollinaire, Breton, Eluard, Tzara, and others. One course. *Thomas*

**166, 167. Contemporary French Life and Thought.** (AL, FL) Major writers of the twentieth century and their historical and cultural circumstances. 166: Proust, Gide and the *Nouvelle revue française*, Colette, Alain-Fournier, Mauriac and the generation of 1914; the social novel of the 1930s. 167: Existentialism and *Les Temps Modernes*, the New Novel, the writer-critics, recent trends. C-L: Comparative Area Studies. One course each. *Kaplan*

**169. The Contemporary Novel in French Canada.** (AL, FL) Major trends in the novel since World War II: social revolt, proletarianism, political and religious liberation, and rejection of the past. C-L: Canadian Studies and Comparative Area Studies. One course. *Keinig and staff*

**181. Intensive Elementary French for Advanced Students.** (FL) Basic grammar structures in one semester; emphasis on oral work. Fall semester only. Prerequisite: four semesters of another foreign language or consent of instructor. One course. *Staff*

**182. Intensive Intermediate French for Advanced Students.** (FL) Review of basic grammar; emphasis on reading, with some practice in writing. Prepares students to enroll in courses at the 100 level. Spring semester only. Prerequisite: French 181 or consent of instructor. One course. *Staff*

**191, 192. Independent Study.** Directed reading and research. Open only to qualified juniors by consent of instructor and Director of Undergraduate Studies. One course each. *Staff*

**193, 194. Independent Study.** Directed reading and research. Open only to qualified seniors by consent of instructor and Director of Undergraduate Studies. One course each. *Staff*

**200S. Seminar in French Literature.** (AL, FL) Topics to be announced. One course. *Staff*

**210. The Structure of French.** (FL) Modern French phonology, morphology, and syntax. Readings in current linguistic theory. C-L: Linguistics. One course. *Hull*

**211. History of the French Language.** (FL) The evolution of French from Latin to its present form; internal developments and external influences. C-L: Linguistics and Medieval and Renaissance Studies. One course. *Hull*

**223. Semiotics for Literature.** (AL) Theoretical writings in general semiotics by Frege, Peirce, Saussure, Mukarovsky, and Morris and their applications for textual analysis of French literary works by representative contemporary critics such as Eco, Riffaterre, Corti, and Greimas. Taught in English. C-L: Literature 280. One course. *Thomas*

**248. French Literature of the Seventeenth Century.** (AL, FL) The baroque and the classical: form and meaning in the plays of Corneille, Racine, and Molière. Readings in baroque and précieux poetry. C-L: Medieval and Renaissance Studies. One course. *Farrell*

**251, 252. Literature of the Eighteenth Century.** (AL, FL) Problems of literary history, critical reading, and interpretation, focused on varying topics. One course each. *Stewart*

**256. Modern Literature and History.** (AL, FL) The problems of history, society, and politics in literature, through the writings of Rousseau, Tocqueville, Michelet, Flaubert, Hugo, Merleau-Ponty, Foucault, and others. C-L: Comparative Area Studies. One course. *Orr*

**258. The Narrative of Social Crisis.** (AL, FL) Realism and naturalism, with special emphasis on Balzac, Flaubert, and Zola. One course. *Bell, Jameson, Orr, or Schor*

**261. French Symbolism.** (AL, FL) Poetry and theories of Baudelaire, Mallarmé, and Rimbaud. Decadence: Lautréamont and Laforgue. One course. *Thomas*

**266. French Literature of the Mid-Twentieth Century.** (AL, FL) Emphasis on Malraux, Sartre, Camus, and the *nouveau roman*. One course. *Jameson*

**267. Contemporary French Novel.** (AL, FL) A chronological and theoretical approach to the major writers and movements since 1970. Selections from Duras, LeClézio, Sallenave, Modiano, Sollers, Tournier, Oulipo, Yourcenar, and others. One course. *Kaplan, Orr, or Thomas*

**290S. Studies in a Contemporary Figure.** (AL, FL) A writer, philosopher, critic, or artist. One course. *Staff*

#### Courses Currently Unscheduled

**114. Language and Civilization of Quebec.** (CZ, FL)

**120. Language, Computers, and Formal Intelligence.** (SS)

**122. The French Film.** (AL, FL)

**132. Literature and History of Quebec.** (AL, FL)

**170. Film and the French Novel.** (AL, FL)

**255. French Preromantic and Romantic Poetry.** (AL, FL)

**257. Problems of Identity in the Nineteenth-Century Novel.** (AL, FL)

**263. Contemporary French Theater.** (AL, FL)

**264. Contemporary French Poetry.** (AL, FL)

**265. French Literature of the Early Twentieth Century.** (AL, FL)

#### ITALIAN (IT)

**1-2. Elementary Italian.** (FL) Understanding, speaking, reading, and writing Italian. Language laboratory available for recording-listening practice. Two courses. *Staff*

**63. Intermediate Italian.** (FL) Grammar review, reading, oral practice including laboratory experience. One course. *Staff*

**76. Advanced Intermediate Italian.** (FL) Oral practice, reading, and composition. Prerequisite: Italian 63 or Achievement or Placement Test score of 550-590. One course. *Finucci or staff*

**101. Writers of the Middle Ages and Quattrocento.** (AL, FL) Readings from Dante, Petrarch, Boccaccio, and the Humanists. C-L: Medieval and Renaissance Studies. One course. *Caserta or Finucci*



**102. Writers from the Renaissance to Preromanticism.** (AL, FL) Readings from Machiavelli, Ariosto, Tasso, Marino, Goldoni, Parini, Alfieri, and others. C-L: Medieval and Renaissance Studies. One course. *Caserta or Finucci*

**103. Italian Poetry and Prose of the Nineteenth Century.** (AL, FL) Works by Foscolo, Manzoni, Leopardi, Verga, and others. One course. *Caserta or Finucci*

**105. Italian Women Writers.** (AL, FL) Representative works by women from the Middle Ages to the modern period. Caterina da Siena, Colonna, Stampa, Aleramo, Deledda, Morante, and others. C-L: Women's Studies. One course. *Finucci*

**111. Advanced Spoken Italian.** (FL) Intensive instruction in Italian using selected topics, readings, and films to build vocabulary and to provide practice in oral communication. Prerequisite: successful completion of Italian 63, 76, or 182 or achievement or placement test score of 600. One course. *Caserta or Finucci*

**121. Aspects of Italian Culture.** (CZ) Offered only as part of the summer program in Italy. Taught in English. One course. *Staff*

**145S. Topics in Renaissance Literature and Culture.** (AL, FL) Topics may include: epic women writers, treatises, Petrarchism. C-L: Medieval and Renaissance Studies. One course. *Finucci*

**181. Intensive Italian.** (FL) An introduction to the language. Prerequisite: four semesters of another foreign language or consent of instructor. One course. *Caserta*

**182. Intensive Italian.** (FL) Readings in modern literature: analysis and discussion. Prerequisite: Italian 181 or consent of instructor. One course. *Caserta*

**191, 192. Independent Study.** Directed reading and research. Open only to qualified juniors by consent of instructor and Director of Undergraduate Studies. One course each. *Staff*

**193, 194. Independent Study.** Directed reading and research. Open only to qualified seniors by consent of instructor and Director of Undergraduate Studies. One course each. *Staff*

**283. Italian Novel of the Novecento.** (AL, FL) Representative novelists from Svevo to the most recent writers. One course. *Caserta*

**284, 285. Dante.** (AL, FL) 284: *La Vita Nuova* and a close reading of the *Inferno*. 285: The *Purgatorio* and the *Paradiso* in the light of Dante's cultural world. Special attention will be given to the poetic significance of the *Commedia*. Reading in Italian or English. Prerequisite: for 285, Italian 284 or equivalent. C-L: Medieval and Renaissance Studies. One course each. *Caserta*

### Courses Currently Unscheduled

**137. The Italian Cinema.** (AL, FL)

### PORTUGUESE (PTG)

**181. Brazilian Portuguese.** (FL) An intensive introduction to the language. Prerequisite: four semesters of another foreign language or consent of instructor. C-L: Comparative Area Studies. One course. *Staff*

**182. Topics in Portuguese and Brazilian Literature and Culture.** (FL) Grammar review, readings, and discussion. Focus on twentieth-century Luso-African, Portuguese, and Brazilian writers. Prerequisite: Portuguese 181 or consent of instructor. C-L: Comparative Area Studies. One course. *Staff*

**191, 192, 193, 194. Independent Study.** One course each. *Staff*

## SPANISH (SP)

**1-2. Elementary Spanish. (FL)** Understanding, speaking, reading, and writing Spanish. Language laboratory available for recording-listening practice. Two courses. *Staff*

**12. Review of Elementary Spanish. (FL)** Intensive review of first-year Spanish. Open only to students with a placement or achievement score of 430-490. May not be taken for credit by students who have taken 1-2. One course. *Staff*

**14. Intensive Elementary Spanish. (FL)** Offered only in the Duke-in-Spain program. Two courses. *Staff*

**63. Intermediate Spanish. (FL)** Grammar review, reading, and oral practice, including laboratory experience. Prerequisite: Spanish 2, 12, or Achievement or Placement Test score of 500-570. One course. *Staff*

**70, 71. Introduction to Literature.** These numbers represent one or two course credits for advanced placement in literature. One course each.

**76. Advanced Intermediate Spanish. (FL)** Oral practice, reading, composition. Prerequisite: Spanish 63 or Achievement or Placement Test score of 580-620. One course. *Staff*

**100S. Introduction to Literary Analysis. (AL, FL)** How to approach different genres in literature. Narrative, poetry, drama, and essay. Texts drawn from different periods of Spanish or Spanish-American literature. One course. *Ross*

**101, 102. Introduction to Spanish Literature. (AL, FL)** Major writers of the Spanish literary tradition. Poetry, fiction, theater, and essay. 101: Middle Ages through the seventeenth century. 102: eighteenth, nineteenth, and twentieth centuries. One course each. *Garci-Gómez, Osuna, and staff*

**103S, 104S. Discussion of Readings. (AL, FL)** Selected topics. Open only to freshmen and sophomores. One course each. *Staff*

**105, 106. Introduction to Spanish-American Literature. (AL, FL)** A survey of major writers and movements from the period of discovery to the present day. 105: the periods of conquest, colonial rule, and early independence. Includes works by native Indian, *mestizo*, and women writers. 106: from *Modernismo* to the contemporary period. C-L: Comparative Area Studies. One course each. *Fein or Ross*

**107S. Spanish-American Short Fiction. (AL, FL)** Novelettes and short stories of the twentieth century: Borges, Cortázar, Denevi, Donoso, García Márquez, and others. C-L: Comparative Area Studies. One course. *Fein*

**109S. Contemporary Hispanic Ideas. (CZ, FL)** Readings in twentieth-century Spanish and Spanish-American nonfiction. Open only to freshmen and sophomores. One course. *Pérez Firmat*

**110. Spoken Spanish. (FL)** Study of colloquial Spanish, practice in pronunciation and conversation, emphasis on oral communication. Prerequisite: Spanish 76 or consent of instructor. One course. *Garci-Gómez and staff*

**111. Written Spanish. (FL)** Grammatical problems in composition and translations; introduction to the techniques of literary and professional styles. One course. *Pérez Firmat and staff*

**114S. Spanish Language: Peninsular or American. (FL)** Topics to be announced. One course. *Staff*

**119S. Structure of Spanish. (FL)** A systematic study of modern Spanish morphology and syntax with some readings in current linguistic theory. Prerequisite: Spanish 110 or 111. C-L: Linguistics. One course. *Staff*

**121. Latin-American Literature in Translation. (AL)** Fictional and poetic works of the last thirty years that have made an impact on world literature. Taught in English. C-L: Comparative Area Studies and Literature 129. One course. *Fein*

**131. Topics of Hispanic Civilization. (CZ, FL)** A humanistic study of Spain or Spanish America through history, culture, people, and institutions. C-L: Comparative Area Studies. One course. *Staff*

**137. Aspects of Contemporary Spanish Culture. (CZ, FL)** Offered only as part of the summer program in Spain. One course. *Garci-Gómez*

**138S. The Spanish Civil War in History and Literature. (AL, FL)** An examination of the Spanish Civil War of 1936-39 through literary and historical readings, and through its representation in art, music, and film. One course. *Sieburth*

**141S, 142S. Spanish Literature. (AL, FL)** Topics to be announced. Open to juniors and seniors. One course each. *Staff*

**143S. Literature of the Discovery and Conquest of America. (AL, FL)** Prose and poetry from the sixteenth through eighteenth centuries, exploring the idea of the New World from conquest to independence. One course. *Ross*

**144S. Spanish-American Literature of Identity. (AL, FL)** Exploration of the concepts of *lo criollo* or *lo americano*, essentially through the analysis of texts by Arriví, Carpentier, Neruda, Paz, and others. One course. *Pérez Firmat*

**145S. Literature of the Hispanic Minorities of the United States. (AL, FL)** Representative Spanish-language works by Puerto Rican, Cuban-American and Chicano writers. One course. *Pérez Firmat*

**146. The Spanish-American Novel. (AL, FL)** Masterworks of the twentieth century. C-L: Comparative Area Studies. One course. *Fein*

**151. Spanish Literature of the Renaissance and the Baroque. (AL, FL)** Selected works of the sixteenth and seventeenth centuries with attention to their reflection of social, religious, and political ideas. C-L: Medieval and Renaissance Studies. One course. *Ross or Wardropper*

**153. Golden Age Literature: Cervantes. (AL, FL)** Emphasis on the *Quijote*. C-L: Medieval and Renaissance Studies. One course. *Staff*

**163. The Generation of 1898. (AL, FL)** Selected works by Unamuno, Baroja, Azorín, Valle-Inclán, and Machado. One course. *Osuna*

**165S. Major Spanish Authors. (AL, FL)** Textual studies; methods of literary interpretation and criticism. One course. *Wardropper*

**166. Nineteenth-Century Prose Fiction. (AL, FL)** Major forms in Spain and Spanish America: Clarín, Blest-Gana, Cambaceres, Galdós, and others. C-L: Comparative Area Studies. One course. *Pérez Firmat or Sieburth*

**171. Literature of Contemporary Spain. (AL, FL)** A sociological approach to the novel, theater, and poetry: Goytisolo, Buero Vallejo, Sastre, Arrabal, Celaya, and Otero. C-L: Comparative Area Studies. One course. *Osuna*

**181. Intensive Elementary Spanish for Advanced Students. (FL)** Basic grammar structures in one semester; emphasis on oral work. Fall semester only. Prerequisite: four semesters of another foreign language or consent of instructor. One course. *Staff*

**182. Intensive Intermediate Spanish for Advanced Students. (FL)** Review of basic grammar; emphasis on reading, with some practice in writing. Prepares students to enroll in courses at the 100 level. Spring semester only. Prerequisite: Spanish 181 or consent of instructor. One course. *Staff*



**191, 192. Independent Study.** Directed reading and research. Open only to qualified juniors by consent of instructor and Director of Undergraduate Studies. One course each. *Staff*

**193, 194. Independent Study.** Directed reading and research. Open only to qualified seniors by consent of instructor and Director of Undergraduate Studies. One course each. *Staff*

**200S. Seminar in Spanish Literature.** (AL, FL) Topics to be announced. One course. *Staff*

**210. History of the Spanish Language.** (FL) Formation and development. Internal forces and external contributions. C-L: Comparative Area Studies, Linguistics, and Medieval and Renaissance Studies. One course. *Garci-Gómez*

**241. Colonial Prose of Spanish America.** (AL, FL) Narrative forms written in Spanish America during the sixteenth, seventeenth, and eighteenth centuries. One course. *Ross*

**245. Modern Spanish-American Poetry.** (AL, FL) From modernismo to the present. C-L: Comparative Area Studies. One course. *Fein*

**246. Modern Spanish-American Fiction.** (AL, FL) Twentieth-century novels and short stories by Borges, Carpentier, Cortázar, Gallegos, García Márquez, Quiroga, and others. C-L: Comparative Area Studies. One course. *Pérez Firmat*

**248. Studies in Spanish-American Literature.** (AL, FL) Concentration on single authors, genres, movements, or themes. One course. *Staff*

**251. The Origins of Spanish Prose Fiction.** (AL, FL) Selected examples of the romance and the novel: *Amadís de Gaula*, Diego de San Pedro's *La Cárcel de amor*, the *Abencerraje*, the *Lazarillo*, Montemayor's *Diana*. C-L: Medieval and Renaissance Studies. One course. *Wardropper*

**254. Drama of the Golden Age.** (AL, FL) The chief Spanish dramatists of the seventeenth century with readings of representative plays of this period. C-L: Medieval and Renaissance Studies. One course. *Wardropper*

**258S. Spanish Lyric Poetry before 1700.** (AL, FL) Selected poems of the Middle Ages, Renaissance, and baroque. Special emphasis on the *Razón de amor*, *la poesía de tipo tradicional*, and Santillana; on Garcilaso, San Juan de la Cruz, Fray Luis de León, and Herrera; on Góngora and Quevedo. C-L: Medieval and Renaissance Studies. One course. *Wardropper*

**262. The Romantic Movement.** (AL, FL) Principal manifestations of romanticism in Hispanic literature; poetry (Becquer, Espronceda, Rosalía de Castro), drama (Rivas, Zorrilla), and the novel (Isaacs, Marmol). One course. *Pérez Firmat*

**266. Nineteenth-Century Prose Fiction.** (AL, FL) Readings by novelists such as Valera, Galdós, Alas, and Pardo Bazán in the light of current critical theory. One course. *Sieburth*

**275. Modern Spanish Poetry.** (AL, FL) Juan Ramón Jiménez, Unamuno, Antonio Machado, the Generation of 1927, and the contemporary poets. One course. *Osuna*

**276. Modern Spanish Drama.** (AL, FL) The theater of Benavente, Valle-Inclán, Lorca, Casona, Buero Vallejo, Sastre, and Arrabal. One course. *Osuna*

**277. Modern Spanish Novel.** (AL, FL) From the Generation of 1898 to the present. One course. *Osuna*

#### Courses Currently Unscheduled

**108S. Spanish Traditional Poetry.** (AL, FL)

- 117S. Advanced Grammar. (FL)  
 118S. Translation from and into Spanish. (FL)  
 133S. Spanish-American Civilization. (CZ, FL)  
 169. Topics in Nineteenth- and Twentieth-Century Spanish Literature. (AL, FL)  
 242. Colonial Poetry and Theater of Spanish America. (AL, FL)  
 253. Cervantes. (AL, FL)

#### ROMANCE STUDIES (RS)

218. **The Teaching of Romance Languages.** Evaluation of objectives and methods; practical problems of language teaching at the elementary, secondary, and college levels; analysis of textbooks, tests, and audiovisual aids. Taught in English. One course. *Tufts*

#### THE MAJOR IN FRENCH OR SPANISH

*Prerequisite.* French or Spanish 74 or 76 or equivalents.

*Major Requirements.* *French:* A total of eight courses numbered 100 or above. These must include 101, 102, and at least three courses above 140. *Spanish:* A total of eight courses numbered 100 or above. These must include two of the following: 101, 102, 105, 106; and at least three courses above 140. Courses numbered 120 through 129 (French and Spanish) are taught in English and do not count toward the major.

*Study Abroad.* Students are strongly urged to study abroad, since this is the best way to achieve language proficiency and to acquire an intimate knowledge of a country's culture. A maximum of two courses per semester, or one per summer, may be counted toward the major. (The summer course restriction does not apply to Duke-sponsored programs.)

*Suggested Work in Related Disciplines.* In order to give perspective to a student's program, majors in French or Spanish will normally select, with the approval of the major advisor, appropriate courses from such fields as: (1) other languages and literatures; (2) history; (3) philosophy; (4) music and art; and (5) linguistics.

#### OPTION FRANÇAIS

Option Français is an offering of courses taught in French. Unlike the French courses offered by the Department of Romance Languages, however, in which language or literature is the essential subject matter, these are courses in various departments where French is simply the medium of instruction. Prerequisite: French SAT score of 600 (or the same score on the Placement Test), a score of 3 on the Advanced Placement Test in French, or prior completion of a French course numbered above 70.

Art 136: Gothic Cathedrals. *Bruzelius*

History 23: Europe to the Eighteenth Century. *Witt*

Music 119: The Humanities and Music. *Bartlet, Higgins, or Seebass*

Music 125: Masterworks of Music. *Seebass*

Sociology 24S: Paris and Montreal in 1900 and 1968. *Tiryakian*

These courses appear also in the listings of the several departments. They meet distributional and Field of Knowledge requirements as these are specified elsewhere in the undergraduate bulletin. They do *not* meet requirements for the major in French.

## Russian

For courses in Russian, see Slavic Languages and Literatures.

# Science, Technology, and Human Values Program

Professor Vesilind, *Director*

A certificate, but not a major, is available in this program.

The Program in Science, Technology, and Human Values offers students the opportunity to develop a comprehensive view of science, medicine, or technology in social, historical, and ethical terms. Although a major is not available in this program, the course of study will enrich the understanding of one's profession for the future scientist, physician, or engineer and will broaden the appreciation of activities in these areas for others.

## COURSE OF STUDY

Duke courses pertinent to the program are classified according to their approach: ethical, analytical (historical, philosophical, or sociological), or policy-centered. Each student entering the program designates, for purposes of advising, an area of primary interest and then selects a program of five courses (four for engineering majors) covering all three approaches. Individual programs, selected from more than fifty courses, are tailored to each student's interests.

Students in the program focus their course work and individual interests through a year-long interdisciplinary seminar offered in the senior year (Interdisciplinary Course 107S, 108S). A seminar consisting of six varied topics in science and the humanities is offered as a course for undergraduates (Interdisciplinary Course 112S, 113S).

Full details concerning the program and courses in science, technology, and human values may be obtained by writing or calling the Director.

## ELIGIBILITY AND CERTIFICATION

Students normally apply to the program at any time before the end of their junior year. On the basis of the expressed area of primary interest, each student is assigned a faculty advisor from the program steering committee, with whom he or she designs a program to suit his or her particular interests. To students who complete the program, Duke University gives official recognition of their participation.

# Slavic Languages and Literatures

Associate Professor Lahusen, *Chairman*; Assistant Professor Pugh, *Director of Undergraduate Studies*; Assistant Professor Andrews, *Supervisor of Language Instruction*; Professor Emeritus Krynski; Associate Professor Emeritus Jezierski; Visiting Assistant Professor Van Tuyl; Lecturer Flath

A major is available in this department.

## RUSSIAN (RUS)

**1-2. Elementary Russian. (FL)** Introduction to understanding, speaking, reading, and writing. Audiolingual techniques are combined with required recording-listening practice in the language laboratory. Two courses. *Staff*

**3. Introduction to Russian Conversation. (FL)** Beginning conversation class: emphasis on everyday use of constructions that present particular difficulties for learners of Russian. Taught in Russian in the U.S.S.R. Prerequisites: Russian 1 and 2, or equivalent. One course. *Staff*

**14. Intensive Russian. (FL)** Russian 1 and 2 combined in one course. Two meetings daily, as well as daily computer and language laboratory work. One course. *Staff*

**63, 64. Intermediate Russian. (FL)** Intensive classroom and laboratory practice in spoken and written patterns. Reading in contemporary literature. Prerequisites: Russian 1 and 2, or two years of high school Russian. One course each. *Staff*



**65. Intermediate Conversation and Composition. (FL)** Consolidation of grammatical skills. Intensive conversation on current topics of interest to students of the U.S.S.R. Development of writing skills. Taught in Russian in the U.S.S.R. Prerequisites: Russian 63 and 64, or equivalent. One course. *Staff*

**66, 67. Russian Conversation. (FL)** Consolidation of oral skills. Intensive conversation on a broad range of topics. Prerequisites: Russian 1 and 2, or equivalent. Half course each. *Staff*

**91S, 92S. Advanced Russian Conversation and Readings. (FL)** Nineteenth- and twentieth-century literature in the original. Conducted in Russian. Prerequisites: for 91S, Russian 63 and 64, or equivalent; for 92S, Russian 91S. One course each. *Staff*

**93. Issues in Contemporary Standard Russian. (FL)** The Russian language in Soviet society: different writing styles; dialects in comparison with standard Russian; sociological implications. Taught in Russian in the U.S.S.R. Prerequisites: Russian 91S and 92S, or equivalent. One course. *Staff*

**100. Studies in Russian Culture. (CZ)** Introduction to the culture and political system of the U.S.S.R. (Taught in the U.S.S.R. in Russian or English depending on placement.) C-L: Comparative Area Studies. One course. *Andrews*

**119. Topics in Eastern and Northern European Languages. (AL)** Introduction to one of the following languages: Bulgarian, Finnish, Serbo-Croatian, or Ukrainian. One year of a foreign language recommended. C-L: Linguistics. One course. *Pugh*

**124. Masters of Russian Short Fiction. (AL)** Pushkin, Gogol, Turgenev, Tolstoy, Dostoevsky, Chekhov, Babel, and others. Taught in English. C-L: Comparative Area Studies. One course. *Staff*

**150. The Languages of the Soviet Union. (FL)** Structural survey of the various language families represented in the U.S.S.R., with special emphasis on national language policy in that country, bilingualism, and language contact. Taught in English. One course. *Pugh*

**161, 162. Introduction to the Russian Novel. (AL)** Outstanding works. 161: Lermontov, Gogol, Turgenev, Goncharov, and Tolstoy. 162: Dostoevsky, Bely, Sologub, Bunin, and Gorky. Taught in English. C-L: Comparative Area Studies. One course each. *Staff*

**175. Tolstoy. (AL)** Introduction to life and works, including: *War and Peace*, *Anna Karenina*, the shorter fiction, dramatic works, and essays. Tolstoy's impact on the literature and thought of today, in and outside of Russia. Taught in English. C-L: Comparative Area Studies. One course. *Staff*

**176. Dostoevsky. (AL)** Introduction to life and works. Emphasis on his relevance to today's world. Readings include: *Crime and Punishment*, *The Idiot*, and *The Brothers Karamazov*. Historical overview of critical reaction in Russia and abroad. Taught in English. C-L: Comparative Area Studies. One course. *Staff*

**180, 181. Twentieth-Century Russian Literature. (AL)** A survey of Russian prose, poetry, and plays by representative authors from Blok to Nabokov. Attention to nonconformist and emigré writers. Taught in English. One course each. *Staff*

**185S. Introduction to Slavic Linguistics. (FL)** Basic introduction to linguistic terminology; emphasis on synchronic linguistic theory in the East, West, and South Slavic areas. Phonological, morphological, and syntactic structure of contemporary standard Russian. Readings in English and Russian. C-L: Comparative Area Studies and Linguistics. One course. *Andrews*

**186S. History of the Russian Language. (FL)** The development of the Russian language from the eleventh century, with consideration of the origins of modern literary and

dialectal features. Readings in Russian. Prerequisite: second year Russian or consent of instructor. C-L: Comparative Area Studies and Linguistics. One course. *Pugh*

**190. The Social History of Russian Literature 1689-1917. (CZ)** An inquiry into the social context of the Russian writer and the creative act. The history of books, publishing, and the changing role of writers in Imperial Russia. Taught in English. One course. *Pelech*

**191, 192. Independent Study.** Directed reading and research. Open only to qualified students by consent of Director of Undergraduate Studies. One course each. *Staff*

**193, 194. Independent Study.** Directed reading and research for qualified seniors. Prerequisite: consent of Director of Undergraduate Studies. One course each. *Staff*

**195. Advanced Russian. (FL)** Review of grammar with an emphasis on the refinement of oral and written language skills. Prerequisite: Russian 92 or consent of instructor. One course. *Staff*

**196. Readings in Modern Russian. (FL)** An intensive reading and conversation course based on contemporary Russian literary and Soviet press texts, emphasizing problems in Russian-English and English-Russian translation. Prerequisite: Russian 195 or consent of instructor. C-L: Comparative Area Studies. One course. *Staff*

**197. Syntax. (FL)** Application of advanced syntactic structures to speech situations and written Russian. Taught in Russian in the U.S.S.R. Prerequisites: Russian 195 and 196, or equivalent. One course. *Staff*

**198, 199. Russian Stylistics and Conversation. (FL)** Refinement of stylistic control and range in spoken and written Russian. Emphasis on fluent discursive skills, as well as development of expository prose style. Prerequisites: Russian 91S and 92S, or equivalent. Half course each. *Staff*

#### For Seniors and Graduates

**205. Semiotics and Linguistics.** A survey of modern semiotics, particularly the works of C. S. Peirce and Umberto Eco. Semiotic works directly related to modern linguistic thought and linguistic sign theory. Emphasis on the interdisciplinary aspects of semiotic theory. C-L: English 205. One course. *Andrews*

**225. Tolstoy. (AL)** *War and Peace* and other works. Prerequisite: Russian 175 or equivalent. C-L: Comparative Area Studies. One course. *Staff*

**232. Dostoevsky. (AL)** Emphasis on *The Brothers Karamazov* and the theory of the novel. Prerequisite: Russian 176 or equivalent. C-L: Comparative Area Studies. One course. *Staff*

**250. Russian Literary Criticism from Lomonosov to Lotman. (AL)** Russian literary criticism from its beginning with Mikhail Lomonosov to its most eminent living practitioner, Iurii Lotman. Some major figures treated are Lomonosov, Karamzin, Belinskii, Chernyshevskii, Dobroliubov, Pisarev, Mikhailovskii, Shklovskii, Bakhtin, Jakobson, Lotman. Taught in English. One course. *Pelech*

#### Courses Currently Unscheduled

**183. Slavic Drama and Theater of the Twentieth Century. (AL)**

**201, 202. Russian Novel of the Nineteenth Century. (AL)**

#### POLISH (POL)

#### Courses Currently Unscheduled

**11. Beginning Polish. (FL)**

**12. Intermediate Polish. (FL)**

**174. The Poles: Literature and Society, 1940-1980. (AL)**

**THE MAJOR**

*Prerequisites.* Russian 1-2 and 63, 64 or equivalent.

*Major Requirements.* A minimum of eight courses in the department. All majors must take the following courses: Russian 91, 92, 195, 196, plus four courses in literature.

Students contemplating graduate work may elect a more intensive program consisting of ten courses. An in-depth knowledge of Russian literature or some knowledge of Polish language and/or literature will facilitate admission to graduate school and subsequent study in the field.

**Sociology (SOC)**

Professor Land, *Chairman*; Associate Professor Wilson, *Director of Undergraduate Studies*; Professors Back, George (Psychiatry and Aging Center), Kerckhoff, Maddox, Myers, O'Barr (Cultural Anthropology), Simpson, Smith, and Tiryakian; Associate Professors DiPrete, Gereffi, O'Rand, and Spenner; Assistant Professor Janoski; Professor Emeritus Preiss; Adjunct Professors Manton (Demographic Studies) and Palmore (Psychiatry and Aging Center); Adjunct Assistant Professor Romanelli (Fuqua School of Business); Lecturer Williams

A major is available in this department.

Sociology combines an appreciation of human beings' capacity for self-realization with a scientific understanding of the causes and consequences of their social behavior. Each course aims to develop both the analytical and critical skills necessary for understanding and evaluating social institutions and social change. Emphasis is upon contemporary research and the use of sociological data in tackling social problems. Active involvement in the learning process is fostered through seminars, independent study, honors work, and internships.

**10D. Introduction to Sociology. (SS)** Structure and dynamics of groups, organizations, and institutions; social behavior over the life cycle; social control and deviance; population and social ecology; formation and change of societies. Two lectures and one discussion section. One course. *Janoski, Simpson, or Tiryakian*

**11. Contemporary Social Problems. (SS)** A survey of approaches to the study of current social problems and social trends. Sexism, racism, age discrimination; job displacement by technological change; social consequences of environmental pollution; unemployment and poverty; interpersonal problems associated with changes in family structures; maldistribution of health care and educational opportunities; deviance. One course. *Land*

**Social Issues of Contemporary Society.** Topics vary from semester to semester. One course each. *Staff*

**20S. Individual and Society. (SS)** One course.

**21S. American Demographics. (SS)** One course.

**22S. The Third World. (SS)** One course.

**23S. Social Organization. (SS)** One course.

**24S. Social History. (SS)** One course.

**25S. Deviance. (SS)** One course.

**49S. Freshman Seminar.** Topics vary each semester offered. One course. *Staff*



**101. Contemporary American Society. (SS)** Social trends and social problems and their effects on individuals and society. Urbanization; bureaucracy; distribution of wealth, income, and power; status of minorities. One course. *Kerckhoff*

**106. Social Psychology. (SS)** See C-L: Psychology 116; also C-L: Women's Studies. One course. *Costanzo or George*

**110. Comparative Sociology. (SS)** Comparative sociological studies focusing on diverse societies of the world. Topics include population and migration, social stratification, the organization of work, urban forms, law and social control, the family, development and global interdependence, culture and communication. C-L: Comparative Area Studies. One course. *Gereffi, Myers, Smith, or Tiryakian*

**111. Inequality in America. (SS)** Differences in social position in the United States as they relate to income, prestige, and power. Primary focus on the process of achievement, including level of education and occupational position, while controlling for race, sex, and age. C-L: Women's Studies. One course. *Kerckhoff or O'Rand*

**112. American Demographics. (SS)** Examination of trends in the fertility, migration, geographic distribution, and composition of the United States population. Consequences for lifestyles, social trends, consumer markets, health care, and public policy. One course. *Land or Myers*

**116. Race and Ethnic Relations. (SS)** History and changing nature of race and ethnic relations, with special reference to the United States. Sources, forms, and consequences of racial discrimination; movements for racial integration and separatism; the intersection of race, class, and gender. C-L: Afro-American Studies 116. One course. *Staff*

**117. Childhood in Social Perspective. (SS)** Social forces affecting the place and purpose of children in society, their relations to adults and their treatment by social institutions such as schools and governments. Topics include parent-child relations, sibling relations, child abuse, children's rights, child labor, and the portrayal of children in the mass media. One course. *Simpson*

**118. Sex, Gender, and Society. (SS)** Nature and acquisition of sex roles. Cross-cultural variations. Developing nature of sex roles in American society. C-L: Comparative Area Studies and Women's Studies. One course. *O'Rand*

**119. Juvenile Delinquency. (SS)** Environments in which juvenile delinquency develops; delinquent subcultures and peer groups; societal reactions to delinquency in schools, courts, and other agencies. One course. *Land*

*Sociology 120, 122, and 123 are designed as a sequence and might optimally be taken in that order, with Sociology 120 being recommended preparation for 122 and 123. However, there are no prerequisites.*

**120. Causes of Crime. (SS)** Definition, types, and extent of crime; biological, psychological, economic, and social causes of criminality; explanation and critical evaluation of theories of crime; structure and patterns of recruitment of criminal organizations; social reactions to crime and the justice system. One course. *Land*

**122. Punishment and Treatment of Deviants. (SS)** Concepts of punishment and rehabilitation. Programs and facilities for deviants. Structure and operation of "total" institutions, such as prisons and hospitals. Problems of returning to family and community life. One course. *Simpson*

**123. Social Aspects of Mental Illness. (SS)** Theoretical and practical sociological contributions to problems of etiology, definition, law, and treatment; comparisons with other contributions; questions of public policy and programs. One course. *Back or Palmore*

**124. Human Development. (SS)** See C-L: Interdisciplinary Course 124; also C-L: Human Development and Psychology 124. One course. *Maddox*

**125. Strategies of Comparative Analysis. (SS)** See C-L: Comparative Area Studies 125; also C-L: Cultural Anthropology 125, History 137, and Political Science 125. One course. *Staff*

**126. Third World Development. (SS)** Theories concerning the role of transnational corporations and international financial institutions (for example, World Bank) in the development of Third World nations, assessed with the aid of sociological and economic data. C-L: Comparative Area Studies. One course. *Gereffi*

**132. Methods of Social Research. (SS)** Principles of social research, design of sociological studies, sampling, and data collection with special attention to survey techniques. One course. *Kerckhoff or Myers*

**133. Statistical Methods. (QR)** Elementary statistical techniques and their application to the analysis and interpretation of social science data. Theory of inference is stressed. Not open to students who have had Mathematics 136, Statistics 10 or 200, or equivalent. C-L: Psychology 117. One course. *Spenner*

**135. Computers and Society. (SS)** The impact of the computer and related technologies on society. Topics include the effects on individual freedom and the nature of work, the implications of high speed information retrieval, and others. One course. *Smith or Spenner*

**138. History of Social Thought. (SS)** Theories of society and social relations in the writings of Montesquieu, Rousseau, Comte, Marx, Weber, Durkheim, Simmel, Veblen, Sorokin, and others. The history of sociology in relation to philosophical currents, social movements, and transformation of the modern world. One course. *Tiryakian or Wilson*

**139. Marxism and Society. (SS)** A critical appraisal of Marxism as a scholarly methodology for understanding human societies. The basic concepts of historical materialism, as they have evolved and developed in historical contexts. Topics include sexual and social inequality, alienation, class formation, imperialism, and revolution. Core course for the program in Perspectives on Marxism and Society. C-L: Cultural Anthropology 139, Education 139, History 186, and Interdisciplinary Course 139. One course. *Fox or Wilson*

**143. Industrial Relations. (SS)** Theories and current research on the interlocking roles of business and labor in the United States and elsewhere. One course. *Gereffi or Janoski*

**149. Sexuality and Society. (SS)** Sociocultural factors affecting sexual behavior. Changing beliefs about sex; how sexual knowledge is socially learned and sexual identities formed; the relation between power and sex; control over sexual expression. One course. *Tiryakian*

**150. The Changing American Family. (SS)** Structure, organization, and social psychology of marital, parental, and sibling relations over the life cycle of a family; courtship, marriage, family dissolution in relation to contemporary American society; deviations from and alternatives to the traditional nuclear family. C-L: Women's Studies. One course. *Kerckhoff or Simpson*

**151. Sociology of Religion. (SS)** The religious factor in modern society and the social factor in modern religion. Major sociological theories and marginal religious groupings. One course. *Tiryakian or Wilson*

**153. Sport and Society. (SS)** The effect of sports on people, their self-image, and social roles. Relation of sports as an institution to the family, education, economics, and politics. One course. *Wilson*

**154. Art and Literature in Society. (SS)** An analysis of the social relations of the world of the arts (painting and sculpture, music, and literature) with emphasis upon creative artists, art publics, art organizations, and art works as they function in their social-cultural milieu. One course. *Back or Tiryakian*

**155. Organizations and Management. (SS)** Forms of work organization (corporations, government agencies), the social forces shaping them (management styles, technology, government policy, labor markets), and their effects on employees (productivity, work satisfaction, turnover). C-L: Women's Studies. One course. *DiPrete or Simpson*

**156. Science, Technology, and Social Change. (SS)** The ways in which society influences the production of scientific knowledge and its transformation into usable technology. Effects of technological and scientific innovation on social life. One course. *O'Rand*

**157. The Legal Profession and the Law. (SS)** Development of the American legal profession, emphasizing the recruitment and training of lawyers, the ways lawyers' work is organized, the role of professional associations, the determinants of success in legal practice, and the influence of legal ethics on practice. One course. *Simpson, Tiryakian, or Wilson*

**158. Markets and Marketing. (SS)** Markets as systems of social exchange: how they are organized and develop; their relationship to other social structures such as families, work organizations and the state; their impact on individuals, careers, consumption patterns, and lifestyles. One course. *Simpson or Spenner*

**159. The Sociology of Entrepreneurship. (SS)** The social origins and careers of entrepreneurs. The interrelation of their work and family roles and the distinctiveness of their values and interests. The role of entrepreneurial activity in societal development, and its function in different industries, ethnic groups, and societies. One course. *Romanelli, Simpson, or Spenner*

**160. Advertising and Society. (SS)** See C-L: Cultural Anthropology 110; also C-L: English 120 and Women's Studies. One course. *O'Barr, J. Smith, or Wilson*

**161. Aging and Death. (SS)** Sociological and psychological perspectives on aging, from adolescence through old age and death; demography of human aging; problems caused by increased longevity; policy issues. C-L: Women's Studies. One course. *George or O'Rand*

**162. Health and Illness in Society. (SS)** Relations between patients and health professionals, and utilization of resources for health care. One course. *Back*

**165. Occupations, Professions, and Careers. (SS)** How occupations organize and control labor markets, define services, chart career lines, and develop and sustain occupational identities. C-L: Women's Studies. One course. *Simpson or Spenner*

**167. The Social Bases of Politics. (SS)** Theories of and research on political power at the community, national, and international levels. C-L: Women's Studies. One course. *Gereffi or Smith*

**169. Psychosocial Aspects of Human Development. (SS)** See C-L: Psychology 130; also C-L: Human Development and Interdisciplinary Course 180. One course. *Martin Lakin and Maddox*

**170. Mass Communication. (SS)** An analysis of the role of radio, the press, magazines, movies, and television. An examination of the selective audiences, content characteristics, controlling elements, and organizational structure of the various media. Comparative Canadian material considered where feasible. C-L: Canadian Studies, Comparative Area Studies, and Film and Video. One course. *Smith*



**171. Comparative Health Care Systems. (SS)** The interaction of historical, political, economic, legal/ethical, and sociological factors in the organization and operation of health care systems in the United States, the United Kingdom, Sweden, and elsewhere. C-L: Comparative Area Studies. One course. *Maddox*

**173. Social Conflict and Social Movements. (SS)** Mobilization and strategy of riots, demonstrations, public interest groups, social movements, and revolutions. One course. *Tiryakian or Wilson*

**175. Contemporary International Problems: Their Historical Origins and Their Implications for Future Policy. (SS)** C-L: Comparative Area Studies 109, Cultural Anthropology 109, History 109, and Political Science 160. One course. *Staff*

**179. Modern Nationalist Movements. (SS)** A comparative sociological study of major nationalist movements: Western nationalism in the nineteenth century, anti-Western movements of the Third World, and regional movements within and against established nation-states. C-L: Canadian Studies and Comparative Area Studies. One course. *Tiryakian*

**182. Media in Comparative Perspective. (SS)** See C-L: Interdisciplinary Course 182; also C-L: Comparative Area Studies and Political Science 180. One course. *Paletz or Smith*

**184. An Introduction to Canada and Canadian Issues. (SS)** See C-L: Interdisciplinary Course 184; also C-L: Canadian Studies, Comparative Area Studies, Economics 184, History 184, and Political Science 184. One course. *Cahow*

**188. The Sociology of Contemporary Spain. (SS)** An overview of the social transformations shaping Spain during the last half-century. Topics covered include the political system, regional autonomous movements, family and educational systems, folklore, and religion. One course. *Staff*

**193, 194. Independent Study.** Prerequisite: consent of instructor. One course each. *Staff*

**195S, 196S, 197S. Seminar in Special Topics.** One course each. *Staff*

### For Seniors and Graduates

**206. Sociological Theory. (SS)** Structure, foundations, and historical antecedents of recent formulations of such theoretical approaches as phenomenological sociology, exchange theory, critical theory, structuralism, neo-Marxist sociology, sociobiology, and action theory. One course. *Tiryakian or Wilson*

**207. Social Statistics I: Basic Concepts and Methods. (QR)** Review of descriptive statistics; probability concepts; statistical inference, t-tests, and the analysis of variance. Bivariate correlation and regression, dummy variables, multiple regression, and the analysis of covariance. Stress on applications. Statistical computing using SPSS and other programs. One course. *DiPrete, Land, or Spenner*

**208. Survey Research Methods. (SS)** Theory and application of survey research techniques in the social sciences. Sampling, measurement, questionnaire construction and distribution, pretesting and posttesting, response effects, validity and reliability, scaling of data, data reduction and analysis. Prerequisite: Sociology 207 or the equivalent. One course. *Back, Kerckhoff, or Smith*

**211S. A-E. Proseminars in Sociological Theory. (SS)** Development of sociological thought; systematic sociological theory; interrelations with other social and behavioral sciences.

A. Background of Sociology

B. Formal Aspects of Theory

- C. Sociology of Knowledge
  - D. Evolutionary Theory and Sociobiology
  - E. Special Topics in Sociological Theory
- One course. *Tiryakian or Wilson*

**212. Social Statistics II: Linear Models, Path Analysis, and Structural Equation Systems. (QR)** Model specification, review of simple regression, the Gauss-Markov theorem, multiple regression in matrix form, ordinary and generalized least squares, residual and influence analysis. Path analysis, recursive and nonrecursive structural equation models; measurement errors and unobserved variables. Application of statistical computing packages. Prerequisite: Sociology 207 or equivalent. One course. *DiPrete, Laud, or Spenner*

**213. Social Statistics III: Discrete Multivariate Models. (QR)** Assumptions, estimation, testing, and parameter interpretation for the log-linear, logit, logistic, and probit models. Model comparisons; applications of statistical computing packages and programs. Prerequisite: Sociology 212 or equivalent. One course. *DiPrete, Laud, or Spenner*

**214. Comparative and Historical Methods. (SS)** Scope, methods, and controversies of comparative and historical sociology. C-L: Comparative Area Studies. One course. *Janoski, Smith, or Tiryakian*

**215. Basic Demographic Methods and Materials. (SS)** Population composition, change, and distribution. Methods of standardizing and decomposing rates, life tables and population models, analysis of data from advanced and developing countries. Applications of computer programs for demographic analysis. Prerequisite: Sociology 207 or equivalent. One course. *Mantou or Myers*

**216. Advanced Methods of Demographic Analysis. (SS)** Theory and estimation methods for life tables. Reproductivity, the stable population model. Graduation, inter-polation, and other data adjustments for faulty data. Hazards modeling. Applications of computer packages for demographic analysis. Prerequisite: Sociology 215 or equivalent. One course. *Laud or Mantou*

**217S. A-F. Proseminars in Social Statistics and Research Methods. (SS)** Selected topics in the collection and analysis of social science data.

- A. Discrete and Continuous Models of Measurement
  - B. Hazards Models, Event History Analysis, and Panel Data
  - C. Dynamic Models and Time Series Analysis
  - D. Research Design
  - E. Evaluation Research Methods
  - F. Special Topics in Social Statistics and Research Methods
- One course. *Staff*

**221S. A-D. Proseminars in Aging and Life Course Analysis. (SS)** Selected topics in socialization, human development, status attainment and careers, and the sociology of aging.

- A. Social Structure and the Life Course
  - B. Social Patterns of Personal Development
  - C. Social Gerontology
  - D. Special Topics in Aging and Life Course Analysis
- One course. *Staff*

**222S. A-D. Proseminars in Comparative and Historical Sociology. (SS)** Selected topics in the differentiation and transformation of societies.

- A. Theories of Social Change
  - B. Comparative Aspects of Societal Transformation
  - C. Theories of Change in Third World
  - D. Special Topics in Comparative and Historical Sociology
- One course. *Gereffi, Siuipson, Smith, or Tiryakian*

**223S. A-E. Proseminars in Crime, Law, and Deviance. (SS)** Selected topics in crime and the institutions of social control.

- A. Theories of Crime Causation
  - B. Human Development and Criminal Careers
  - C. Social Control and the Criminal Justice System
  - D. Sociology of Law
  - E. Special Topics in Crime, Law, and Deviance
- One course. *Land, Simpson, Tiryakian, or Wilson*

**224S. A-F. Proseminars in Population Studies. (SS)** Selected topics.

- A. Population Dynamics
  - B. Mortality, Morbidity, and Epidemiology
  - C. Urbanization and Migration
  - D. Demography of the Labor Force
  - E. Demography of Aging
  - F. Special Topics in Population Studies
- One course. *Back, DiPrete, Land, Maddox, Manton, Myers, O'Rand, or Smith*

**225S. A-E. Proseminars in Organizations, Markets, and Work. (SS)** Selected topics in complex organizations, the labor process, and changing occupations.

- A. Organizations and Environments
  - B. The Social Psychology of Organizations
  - C. Markets and Market Behavior
  - D. Careers and Labor Markets
  - E. Special Topics in Organizations, Markets, and Work
- One course. *Janoski, O'Rand, or Spenner*

**226S. A-H. Proseminars in Social Institutions and Processes. (SS)** Selected topics in the sociology of institutions and social and institutional behavior.

- A. Social Psychology
  - B. Social Stratification
  - C. Political Sociology
  - D. Sociology of Religion
  - E. Sociology of Science
  - F. Sociology of Education
  - G. Medical Sociology
  - H. Special Topics in Social Institutions and Processes
- One course. *Staff*

**255. Political Sociology. (SS)** Pluralist, elite, and class theories of the relationship between state and society. Topics include: recent debates on the welfare state, social control, political participation, and state-society relations in socialist economies. C-L: Political Science 255. One course. *Smith or Tiryakian*

**282S. Canada. (SS)** See C-L: History 282S; also C-L: Canadian Studies, Comparative Area Studies, Cultural Anthropology 282S, Interdisciplinary Course 282S, and Political Science 282S. One course. *Cahow*

**284S. Feminist Theory and the Social Sciences. (SS)** See C-L: Interdisciplinary Course 284S; also C-L: Cultural Anthropology 284S, History 284S, Political Science 264S, Psychology 284S, and Women's Studies. One course. *Chafe, Neuschel, O'Rand, C. Smith, or Spenner*

**298S, 299S. Seminar in Selected Topics.** Substantive, theoretical, or methodological topics. One course each. *Staff*

## COURSES CURRENTLY UNSCHEDULED

**102. America in the Modern World System. (SS)**



140. Environment and Society. (SS)

189. The Americas: A Survey of the Forces Shaping the Hemisphere. (SS)

234S. Political Economy of Development: Theories of Change in the Third World. (SS)

## THE MAJOR

*Prerequisite.* Sociology 10D or an equivalent course with consent of the Director of Undergraduate Studies.

*Major Requirements.* Eight courses above 101: Sociology 132, 133, 138, one 200-level course, and four others. Only one independent study credit can be applied to the major; it may not substitute for a required course.

A student may complete a second major in sociology. Requirements and advising are the same for the second major as for the first major.

*A Handbook for Sociology Majors*, available in the office of the Director of Undergraduate Studies, describes areas of concentration, the honors program, and the Sociology Union. It also describes the departmental advising system and the interests of the faculty.

## Institute of Statistics and Decision Sciences (STA)

Professor Geweke, *Director*; Associate Professors Burdick, West, and Wolpert; Assistant Professor Lavine; Visiting Professor Richard

The Institute of Statistics and Decision Sciences coordinates teaching and research in statistics and decision theory at Duke. It offers various courses in basic statistics and advanced mathematical statistics. The research emphasis on statistical decision theory in the institute leads to its offering a variety of courses, at various levels, in statistics and decision sciences. There is no undergraduate major in statistics. The institute maintains and runs a Statistical Consulting Center which provides help on statistics problems and projects for members of the Duke community.

**10D. Basic Statistics. (QR)** Statistical concepts involved in making inferences, decisions, and predictions from data. Emphasis on applications, not formal technique. Not open to students who have had Economics 138, Mathematics 53, Political Science 138, Psychology 117, Public Policy Studies 112, or Sociology 133. One course. *Staff*

**20. Introduction to Decision Analysis. (QR)** Frameworks for identifying and analyzing choices and their consequences. Elementary probability theory and applications, utility, risk and decision trees. Introduction to constrained optimization theory and application. One course. *Staff*

**30. Applied Game Theory. (QR)** Introduction to theory of games through its application to economics, political science, animal behavior, and decision analysis. One course. *Staff*

**100. Introduction to Applied Statistics. (QR)** Classical techniques of testing and estimation. Emphasis on applications of the theory to applied problems. Not open to students who have taken Statistics 200 or equivalent. Prerequisite: Mathematics 103 (may be taken concurrently) or equivalent, or consent of instructor. One course. *Staff*

**191, 192. Independent Study.** Directed reading and research. Prerequisites: consent of instructor and Director of Undergraduate Studies. One course each. *Staff*

**200. Introduction to Statistical Methods. (QR)** Emphasis on classical techniques of hypothesis testing and point and interval estimation, using the binomial, normal, t, F, and chi square distributions. Not open to students who have taken Economics 237 or Mathematics 117. Prerequisite: Mathematics 103 (may be taken concurrently) or equivalent, or consent of instructor. One course. *Staff*

**205S. Senior Seminar in Statistics. (QR)** Illustrative past topics: empirical applications of classical and Bayesian methods; robustness and model specification; time series analysis; applications of probability theory. Prerequisite: Statistics 200 or Mathematics 136. One course. *Staff*

**210. Bayesian Statistics. (QR)** Foundations of Bayesian theory. Bayesian versus classical inference procedures; applications to simple random processes. Introduction to Bayesian computer software. Prerequisite: Statistics 200 or consent of instructor. One course. *Richard*

**220. Decision Analysis.** Decision making under uncertainty. Theory and methods of structuring problems, defining uncertainty, and satisfying multiple objectives. Theories of risk, information, and psychological bias. Prerequisite: Statistics 200 or consent of instructor. C-L: Business Administration 491. One course. *Winkler*

**222. Quantitative Methods and Statistics. (QR)** Review of multivariate calculus; optimization methods; linear algebra for statistics; introduction to probability and statistics, with emphasis on applications of the theory to applied problems. Not open to students who have taken Statistics 100 or 200. Prerequisite: Mathematics 32, 34, 36, or 41. Two courses. *Staff*

**224D. Statistics and Data Analysis. (QR)** Elements of statistical inference and estimation including exploratory data analysis, regression, and analysis of variance. One course. *Wolpert*

**226. Optimization Methods. (QR)** Introductory survey of optimization techniques useful in management and social decision making. Numerical techniques for unconstrained optimization, linear and dynamic programming, and optimal control methods. Prerequisite: consent of instructor. One course. *Wolpert*

**240. Applied Stochastic Processes. (QR)** Prerequisite: Statistics 200 or equivalent. See C-L: Mathematics 240. One course. *Staff*

**241. Linear Models. (QR)** Geometrical, interpretation, multiple regression, analysis of variance, experimental design, analysis of covariance. Prerequisite: Statistics 200 or equivalent. C-L: Mathematics 241. One course. *Staff*

**242. Multivariate Statistics. (QR)** Multinormal distributions, multivariate general linear model, Hotelling's  $T^2$  statistic, Roy union-intersection principle, principal components, canonical analysis, factor analysis. Prerequisite: Statistics 241 or equivalent. C-L: Mathematics 242. One course. *Staff*

**243. Econometrics I. (SS)** See C-L: Economics 243. One course. *Staff*

**244. Applied Regression Analysis. (QR)** Regression analysis with nonexperimental data using ordinary least squares. Emphasis on assumption violations: consequences and correctives. Analysis of variance and time series analysis. Prerequisite: Statistics 224 or equivalent. One course. *Burdick*

**245. Econometrics II. (SS)** See C-L: Economics 245. One course. *Staff*

**246. Selected Topics in Econometric Theory. (SS)** See C-L: Economics 246. One course. *Staff*

**247S. Applied Econometrics. (SS)** See C-L: Economics 247S. One course. *Staff*

**248, 249. Topics in Statistics. (QR)** Advanced topics in analysis of variance, design of experiments, nonparametric statistics, foundations of statistical inference. Prerequisite: Statistics 200 or consent of instructor. One course each. *Staff*

## Swahili

For courses in Swahili, see Asian and African Languages.

## University Writing Program (UWC)

Associate Professor Gopen, *Director*

The writing requirement may be fulfilled by successfully completing University Writing Course 4, 5, 6, 7, or 8, each of which involves expository themes and regular individual conferences. Despite the distinction in titles and topics, all these courses deal with the same core concerns and have the same objective: they are intended to help students of all abilities to a greater understanding of the language and thereby to a greater control of their thinking process.

**4. Principles of Writing.** Designed for those who would benefit from a small class that concentrates on the principles of clear, sophisticated, college-level prose. Essays are based on a variety of topics. One course. *Staff*

**5. Persuasive Writing.** Differs from University Writing Course 4 in only three ways: (1) the essays in each course section are based on a single topic, the readings for which are primarily nonfiction; (2) the class size is slightly larger; and (3) the pace may be somewhat faster. One course. *Staff*

**6. Interpretive Writing.** Differs from University Writing Course 5 only in that the essays in each course section are based primarily on readings in literature, selected to form a single literary topic for the term. One course. *Staff*

**7. Writings on Special Topics.** Themes and readings vary with the topic of each section. Enrollment in some sections may be restricted to students in specified programs. One course. *Staff*

**8. Expository and Persuasive Writing.** This course, which covers the rhetorical principles available in University Writing Course 4, 5, 6, and 7, is offered only in the spring. The readings vary with the individual instructors. Not open to students who have passed 4, 5, 6, or 7. One course. *Staff*

**117S. Advanced Expository and Persuasive Writing.** Emphasis on the connections between substance and structure; revision techniques and inventional procedures. Tailored to the level, needs, and interests of students who enroll. Prerequisite: previous University Writing Course or consent of the director of the University Writing Program. C-L: English 117S. One course. *Staff*

*For other courses in writing, see listings for Department of English.*

## Women's Studies Program

Associate Professor J. O'Barr, *Director*

A certificate, but not a major, is available in this program.

The program in women's studies provides for students an understanding of the forces that shape the position of women in society and develops an appreciation of women's experiences. Women's studies brings together faculty and students from many disciplines who share an interest in studying women's experiences and who incorporate ideas and information about these experiences into research, teaching, and learning. Women's studies encourages students to question and reinterpret existing bodies of information and theories and to include women's perspectives and contributions in the new interpretation.

Courses in women's studies, open to all Duke students, are offered through a number of academic departments and through the interdisciplinary course designation. A



certificate, representing an area of concentration supplementing a major, is available for students in the program. Students working toward the certificate declare a major outside the program and utilize women's studies as a valuable additional area of academic concentration.

To earn a certificate, students take a minimum of five women's studies courses: Interdisciplinary Course 103, An Introduction to Women's Studies; three departmental courses that focus on women, at least one in the area of social sciences and one in arts and literature or civilizations; and one course on women in relation to culture and society. Interdisciplinary Course 195S, Senior Seminar in Women's Studies, is offered every spring, and can be taken in place of Interdisciplinary Course 103 (with the director's approval) if the student has completed several courses in women's studies prior to the senior year. The senior seminar is also strongly recommended as a sixth course for students earning the certificate. With approval of the director, one independent study course (taken at Duke or abroad) may count toward the certificate. Four out of the five courses taken for the certificate must be at the 100-level or above, and not more than one may be at the 200-level.

Students earning the undergraduate certificate are eligible for graduation with distinction in women's studies. Guidelines for honors in women's studies are available in the program office.

The courses listed below are offered regularly and can be used to fulfill the requirements for the certificate. For a more detailed description of each course, consult the listing in the appropriate department or contact the Women's Studies Program Office.

## REGULARLY SCHEDULED COURSES

### Core Interdisciplinary Courses

- Interdisciplinary Course 103. An Introduction to Women's Studies. *J. O'Barr and staff*
- Interdisciplinary Course 195S. Senior Seminar in Women's Studies. *J. O'Barr and staff*
- Interdisciplinary Course 211S. History of Feminist Thought. *Neuschel, J. O'Barr, or Pope*
- Interdisciplinary Course 283S. Feminist Theory and the Humanities. C-L: English 283S and Religion 283S. *Clark, Orr, Pope, or Tompkins*
- Interdisciplinary Course 284S. Feminist Theory and the Social Sciences. C-L: Cultural Anthropology 284S, History 284S, Political Science 264S, Psychology 284S, and Sociology 284S. *Chafe, Neuschel, O'Rand, C. Smith, or Spenner*

### Departmental Courses on Women/Gender

- Arabic 173S. Women in Arabic Literature. *Cooke*
- Classical Studies 104. Women in the Ancient World. *Boatwright*
- Cultural Anthropology 113. Cultural Construction of Gender. *Quinn*
- Cultural Anthropology 114. Gender Inequality. *Quinn*
- Cultural Anthropology 272S. Marxism and Feminism. *Smith*
- English 269. American Women Writers. *Pope or Tompkins*
- French 108S. French Women: Myths, Realities, and the Law. *Bryan*
- French 159. Feminist Fiction. *Orr*
- History 169S, 170S. The Social History of American Women. *A. Scott*
- History 171. A History of Women in Europe. *Neuschel*
- History 199. The History of Women in Science and Medicine. *Green*
- Italian 105. Italian Women Writers. *Finucci*
- Music 120S. Women in Music. *Higgins*
- Philosophy 122. Philosophical Issues in Feminism. *Lind*
- Political Science 163. Gender, Politics, and Policy: The Third World Case. *J. O'Barr*
- Psychology 164S. Psychology of Women. *Roth*
- Religion 109. Women in the Biblical Tradition: Image and Role. *C. Meyers*
- Religion 125. Women and Sexuality in the Christian Tradition. *Clark*
- Sociology 118. Sex, Gender, and Society. *O'Rand*

### Departmental Courses on Women in Relation to Culture and Society

- Cultural Anthropology 110. Advertising and Society. *W. O'Barr*
- Cultural Anthropology 126. Middle East: Wars, Revolutions, and Social Change. *Dominguez*
- Cultural Anthropology 137. Incest, Adultery, and Other Problems in Kinship and Marriage. *Dominguez or Quinn*
- Cultural Anthropology 141. The Self and Others: Ethnic, Racial, and Social Classifications. *Dominguez*

Cultural Anthropology 251S. American Marriage: A Cultural Approach. *Quinn*  
 Economics 208S. Economics of Labor Supply and the Family. *McElroy*  
 English 187. Melodrama and Soap Opera. *Gaines*  
 History 115. History of Africa. *Ewald*  
 History 117. Early Modern Europe. *Neuschel*  
 History 160. The United States from the New Deal to the Present. *Chafe*  
 Interdisciplinary Course 155. Comparative Perspectives on Literature and Social Change: From Plantation to City. *Willis*  
 Literature 128. Writings in the Pan-African Tradition. *Willis*  
 Literature 177. Film Theory. *Gaines*  
 Literature 185. Psychoanalysis, Literature, and Film. *Gaines*  
 Political Science 129. Political Participation. *Paletz*  
 Political Science 153, 154. Politics and the Media of Mass Communication. *Paletz*  
 Political Science 187. Politics and the Libido. *Paletz*  
 Religion 234. Early Christian Asceticism. *Clark*  
 Sociology 106. Social Psychology. *George*  
 Sociology 111. Inequality in America. *Kerckhoff or O'Rand*  
 Sociology 149. Sexuality and Society. *Staff*  
 Sociology 150. The Changing American Family. *Kerckhoff or Simpson*  
 Sociology 161. Aging and Death. *George or O'Rand*  
 Sociology 165. Occupations, Professions, and Careers. *Simpson or Speuwer*

## OTHER PERTINENT COURSE OFFERINGS

In addition to the regular courses listed above, the following sections of general courses are offered by women's studies faculty members in various departments. These sections focus specifically on topics relevant to women; they count toward the women's studies certificate requirements only when offered on these specific topics by the women's studies faculty members listed here. Also, house courses, taken for half credit through Duke dormitories, are frequently offered and sponsored through the Women's Studies Program. Students should consult the Women's Studies Program each semester for information on all courses.

### Departmental Courses on Women/Gender

Classical Studies 195S, 196S. Sex Roles in Antiquity. *Boatwright*  
 Cultural Anthropology 180. Sociobiology and Gender. *Wright*  
 English 179S. Portraits of the Lady: Studies in the Literary Images of Women. *Pope*  
 English 179S. Studies in Women's Fiction. *Pope*  
 French 104S. Women in Contemporary France. *Bryan or Orr*  
 French 290S. Studies in a Contemporary Figure: Wittig. *Orr*  
 History 196S. Problems in the History of Women in Europe. *Neuschel*  
 History 196S. Issues in Third World Women's History. *Ewald*  
 Political Science 200S A. Contemporary American Feminism. *J. O'Barr*  
 Public Policy Studies 264S. Women and Justice. *Stack*

### Departmental Courses on Women In Relation to Culture and Society

English 26S. Solitary in Fiction. *Pope*  
 English 154. American Literature: 1915-1960. *Pope*  
 English 163. Twentieth-Century American Poetry. *Pope*  
 English 189S. Sexualities in Film and Literature. *Gaines*  
 English 288. The Western in American Culture. *Tompkins*  
 French 166, 167. Contemporary French Life and Thought. *Kaplan*  
 Public Policy Studies 195S. Poverty and Progress. *Staff*  
 Public Policy Studies 278. Human Service Bureaucracies. *Staff*  
 Spanish 166. Nineteenth-Century Prose Fiction. *Sieburth*

In addition to offering courses and a certificate representing a concentration in women's studies, the Women's Studies Program sponsors lectures, films, discussions, conferences, and internships that focus on women's issues. It provides academic advice and assistance to students earning certificates in the program. Additional information on courses, the women's studies certificate, and other opportunities in women's studies is available at the Office of Women's Studies, 207 East Duke Building.

## Writing

See University Writing Program.

## Zoology (ZOO)

Professor Gillham, *Chairman*; Professors Costlow, Fluke, Forward, Klopfer, Livingstone, McClay, Nicklas, H. Nijhout, Ruderman, Staddon, Tucker, Vogel, Wainwright, Ward, and H. Wilbur; Associate Professors Laurie, Lundberg, Rausher, Sutherland, and Uyenoyama; Assistant Professors Nowicki and Roth; Professors Emeriti Bailey, Bookhout, Gregg, Schmidt-Nielsen, and K. Wilbur; Adjunct Professor Schmidt-Koenig; Lecturer M. Nijhout

See Biology for a description of the major and the list of courses taught by the zoology faculty.

## School of Engineering

Professor Dowell, *Dean*; Professor Shepard, *Associate Dean*

### ENGINEERING (INTERDEPARTMENTAL) (EGR)

**23. Principles and Practices in Engineering Economics.** Introduction to the principles and practices in engineering economics. The initial set of lectures develops a general understanding of basic engineering economics and break-even analysis/minimum cost in engineering design. The second set of lectures focuses on industrial practices and public projects: interest formulas, annual and present worth, as well as taxes and depreciation. The final lectures address forecasting and uncertainty in engineering economics. (1.0 ES) Prerequisite: sophomore standing. One course. *Peirce*

**24. Environmental Engineering Science.** Materials and energy balances applied to environmental engineering problems. Water pollution control, applied ecology, air quality management, solid and hazardous waste control. Environmental ethics. (1.0 ES) Prerequisite: Chemistry 11. One course. *Vesilind*

**50. Introduction to Numerical Computing.** Introduction to the use of computers in the solution of engineering and scientific problems. Systematic methods for algorithm development and coding in a higher-level computer language. Application of selected numerical methods. Offered in summer only. One course. *Pas*

**51. Computers in Engineering.** Introduction to use of digital computers in engineering. Attributes of digital computer systems; program languages; algorithm development; numerical analysis, including approximation and interpolation, searches and maximization, linear equations; applications to engineering; interactive computing, editing, and file handling; computer graphics. Not open to students who have completed Computer Science 51 or Engineering 52. (1.0 ES) One course. *Melosh, Pas, or Utku*

**52. Computational Methods in Engineering.** Introduction to computer methods and algorithms for analysis, simulation, and optimization of engineering systems; matrix, direct, and iterative analysis techniques; finite increment techniques; linear programming. Requires prior programming experience and learning FORTRAN or Pascal type languages with minimal help from the course. Not open to students who have completed Computer Science 51 or Engineering 51. (1.0 ES) One course. *Melosh or Utku*

**75. Mechanics of Solids.** Analysis of force systems and their equilibria as applied to engineering systems. Stresses and strains in deformable bodies; mechanical behavior of materials; applications of principles to static problems of beams, torsion members, and columns. Selected laboratory work. (1.0 ES) Prerequisites: Physics 51 and Mathematics 32. One course. *Hueckel, Melosh, Petroski, or J. F. Wilson*



**83. Structure and Properties of Solids.** Introduction to materials science and engineering, emphasizing the relationships between the structure of a solid and its properties. Atomic and molecular origins of electrical, mechanical, and chemical behavior are treated in some detail for metals, alloys, polymers, ceramics, glasses, and composite materials. (.25 ED/.75 ES) Prerequisites: Chemistry 11 and Mathematics 31. One course. *Cocks, Jones, Needham, or Shepard*

**101. Thermodynamics.** The principal laws of thermodynamics for open and closed systems and their application in engineering. Properties of the pure substance, relationships among properties, mixtures and reactions. Power and refrigeration cycle analysis. (1.0 ES) Prerequisite: Physics 52. One course. *Chaddock or Harman*

**123. Dynamics.** Principles of dynamics of particles, rigid bodies, and selected non-rigid systems with emphasis on engineering applications. Kinematic and kinetic analysis of structural and machine elements in a plane and in space using graphical, computer, and analytical vector techniques. Absolute and relative motion analysis. Work-energy; impact and impulse-momentum. Laboratory experiments. (1.0 ES) Prerequisites: Mathematics 103 and Engineering 75 or consent of instructor. One course. *Petroski or J. F. Wilson*

**130. Modeling and Analysis of Dynamic Systems.** Mathematical modeling of mechanical, electrical, fluid, and thermal systems. Emphasis is placed on a universal approach to system analysis. Topics include: state variables, linearization methods, transfer functions and block diagrams, and feedback techniques for the control of dynamic systems. (.25 ED/.75 ES) Prerequisites: Mathematics 103 and Physics 51. One course. *Garg, Quinlan, or Wright*

**150. Engineering Communication.** Principles of written and verbal technical communication; graphics, mapping, surveying and engineering drawing. Computer graphics, two- and three-dimensional transformations, hidden-surface and hidden-line algorithms, and computer aided design. (1.0 ES) Prerequisite: Engineering 51 or equivalent. One course. *Pas and Vesilind*

**151. Computer Simulations in Engineering.** Simulation of various engineering systems, starting from their mathematical formulations. Simulation of the boundary value, eigenvalue, and the initial value problems. Examples from the beam-, truss-, and plate-theories, the fluid flow, the heat transfer, and the dynamics of mechanical and electrical systems. Use of widely used numerical algorithms. Identification of the problems associated with numerical simulations. (1.0 ES) Prerequisite: junior standing in engineering. One course. *Utku*

**165. Special Topics in Engineering.** Study arranged on special engineering topics in which the faculty have particular interest and competence as a result of research or professional activities. Quarter course, half course, or one course. Prerequisite: consent of instructor(s). Variable credit. *Staff*

**174. Technology Assessment and Social Choice.** Societal, economic, environmental, psychological, and ethical considerations in the design and application of technological systems; techniques for technological forecasting and assessment; citizen participation in policy-making; recent case studies; interdisciplinary team project. (.75 ED/.25 ES) C-L: Religion 174. One course. *Garg and McCollough*

**175. Aesthetics, Design, and Culture.** An examination of the role of aesthetics, both as a goal and as a tool, in a culture which is increasingly dependent on technology. Visual thinking, perceptual awareness, experiential learning, conceptual modeling, and design will be explored in terms of changes in sensory environment. Design problems will be formulated and analyzed through individual and group design projects. (.5 ED/.5 ES) One course. *Pearsall*

**183, 184. Projects in Engineering.** Courses in which engineering projects of an interdisciplinary nature are undertaken. The projects must have engineering relevance in the sense of undertaking to meet human need through a disciplined approach under the guidance of a member of the engineering faculty. Prerequisite: consent of instructor. One course each. *Staff*

**221. Computational Linear Algebra.** Linear vector spaces of real and complex  $n$ -tuples, norms, metrics, inner-products, basis vectors, rank and dimensionality; matrices as linear maps, rank and nullity, particular and general solutions of  $Ax = b$ ; factorization of matrices by successive transformations; solution of  $Ax = b$  by direct and iterative methods; special and general eigenvalue problems; diagonalization and tridiagonalization by similarity transformations; power methods, computational complexities, storage requirements, convergence characteristics, error propagation, and the mathematical basis of the studied algorithms. (1.0 ES) Prerequisites: Mathematics 111 or equivalent, and knowledge of any algorithmic programming language. One course. *Utku*

**222. Computer Solutions of Ordinary and Partial Differential Equations.** Ordinary differential equations; initial value problems; Lipschitz conditions; single and multi-step methods; predictor-corrector methods; stability and error control; elliptic partial differential equations; linear boundary value problems, solutions by finite differences and finite elements; parabolic differential equations, initial value problems, solutions by successive boundary value problems; stability and error control; hyperbolic differential equations; propagation of discontinuities; method of characteristics. (1.0 ES) Prerequisite: Engineering 221 or consent of instructor. One course. *Utku*

## COURSES CURRENTLY UNSCHEDULED

135. Continuum Mechanics

170. Forecasting Techniques

172A. Contemporary Science: Issues and Challenges

172B. Contemporary Technology: Issues and Challenges

187. History of Nuclear Energy: Civilian Applications

188. History of Nuclear Energy: Military Applications

## Biomedical Engineering (BME)

Professor McElhaney, *Chairman*; Professor Clark, *Director of Undergraduate Studies*; Professors Barr, Hammond, Hochmuth, Nolte, Pilkington, Plonsey, von Ramm, and Wolbarsht; Associate Professors Burdick, Jaszczak, and Pasipoularides; Assistant Professors Daniels, Reichert, Smith, Trahey, and Truskey; Research Professor Thurstone; Research Assistant Professors Altman, Bohs, Cusma, Floyd, Krassowska, Nandedkar, and Paver; Adjunct Associate Professors Cooper and Joost

A major is available in this department.

Biomedical engineering is the discipline in which the physical, mathematical, and engineering sciences and associated technology are applied to biology and medicine. Contributions range from modeling and simulation of physiological systems through experimental research to solutions of practical clinical problems. The undergraduate program in biomedical engineering is flexible and can satisfy the requirements for entrance into graduate work in engineering, medicine, and other professional schools or science disciplines.

Opportunities for student research are available in the biomedical engineering laboratories. The department utilizes digital computers extensively, and computer science techniques are applied in acquiring, processing, and modeling biological data. Research in

the biomedical materials laboratory is directed toward the development of materials suitable for use in biological environments such as the vascular system. Biomedical engineering in pediatric cardiology involves study of the electrical activity of the heart and heart tissues in animals and humans, to increase the basic knowledge of their normal and abnormal behavior. Other electrophysiological systems are examined through the application of models and simulation techniques. The ultrasound imaging laboratories are employed for research and instruction in the biomedical application of this important technique. Ultrasound instrumentation measures and images biological tissue structures, and the laboratories are equipped with a variety of advanced ultrasonic imaging instruments. A transducer fabrication facility, test equipment for the design and construction of advanced ultrasound systems, a dedicated VAX 11/780 computer for image processing, and extensive video recording and display facilities are available. Other areas of research and instruction in medical imaging include digital angiography and MR imaging. The biomechanics laboratory is equipped to measure biomechanical responses of tissues and organs and gait parameters, and to test protective headgear and develop new prosthetic devices. Additional opportunities are available in biological fluid mechanics, lipid transport mechanisms, and biosensors.

**7. Membranes.** An introduction to the elementary properties of membranes, both electrical and mechanical from a mathematical perspective, with some computer exercises. Intended for freshmen who are prospective biomedical engineering majors. (.5 ED/.5 ES) One course. *Barr*

**101. Electrobiological.** The electrophysiology of excitable cells from a quantitative perspective. Topics include the ionic basis of action potentials, the Hodgkin-Huxley model, impulse propagation, source-field relationships, and an introduction to functional electrical stimulation. (.25 ED/.75 ES) Prerequisite: Biomedical Engineering 163 or Electrical Engineering 62. One course. *Barr or Plonsey*

**106. Mass and Energy Balances in Chemical and Biological Systems.** Engineering problems involving material and energy balances taken from chemical and biochemical process industries and mammalian physiology. Batch and continuous reactive systems in the steady and unsteady state. Humidification processes. Metabolism. (.5 ED/.5 ES) Prerequisite: Chemistry 12. One course. *Clark*

**110. Introductory Biomechanics.** Static and dynamic analysis of biological systems; analysis of gait and locomotion; ballistocardiography; biomechanical aspects of various sport activities, diving, and jumping; power, work, and energy concepts applied to the human body; strength and properties of tissue; and injury mechanisms and tolerance. (.25 ED/.75 ES) Prerequisites: Mathematics 32 and Physics 51. One course. *McElhany*

**145. Chemical Thermodynamics.** Thermodynamic properties and thermodynamic state. Exchange of heat and work in quasi-equilibrium processes. Chemical and phase equilibria of multicomponent mixtures. (.5 ED/.5 ES) Prerequisite: junior standing. One course. *Clark, Daniels, or Truskey*

**163, 164. Biomedical Electronics and Measurements.** A study of the basic principles of biomedical electronics and measurements with emphasis on the operational performance and selection of transducers, instruments, and systems for biomedical data acquisition and processing. Selected laboratory work emphasizes the measurements of specific physiological events. (.5 ED/.5 ES each) Prerequisite: Electrical Engineering 61. One course each. *Hammond, Trahey, or von Ramm*

**171. Signals and Systems.** Convolution, deconvolution, Fourier series, Fourier transform, sampling, and the Laplace transform. Continuous and discrete formulations with emphasis on computational and simulation aspects and selected biomedical examples. (1.0 ES) One course. *Pilkington*



**191, 192. Projects in Biomedical Engineering.** For seniors who express a desire for such work and who have shown aptitude for research in one area of biomedical engineering. Half course to two courses. (.5 ED/.5 ES) Variable credit. *Staff*

**201. Electrophysiology.** The electrophysiology of excitable cells from a quantitative perspective. Topics include the ionic basis of action potentials, the Hodgkin-Huxley model, impulse propagation, source-field relationships, and an introduction to functional electrical stimulation. Students choose a relevant topic area for detailed study and report. Not open to students who have taken Biomedical Engineering 101 or equivalent. (.25 ED/.75 ES) One course. *Barr or Plonsey*

**205, 206. Microprocessors and Digital Instruments.** Design of microcomputer-based devices including both hardware and software considerations of system design. Primary emphasis on hardware aspects, including a progression through initial design, prototype construction in the laboratory, testing of prototypes to locate and correct faults, and final design evaluation. Evaluation includes examination of complexity, reliability, and cost. Design and construction oriented toward biomedical devices or instruments that include dedicated microcomputers, usually operating in real time. (.5 ED/.5 ES each) Prerequisites: for 205, Engineering 51 and Biomedical Engineering 163, 164 or equivalents; for 206, satisfactory work in 205. One course each. *Barr, Hammond, or von Ramm*

**207. Transport Phenomena in Biological Systems.** An introduction to the modeling of complex biological systems using principles of transport phenomena and biochemical kinetics. Topics include the conservation of mass and momentum using differential and integral balances; rheology of Newtonian and non-Newtonian fluids; steady and transient diffusion in reacting systems; dimensional analysis; homogeneous versus heterogeneous reaction systems. Biomedical and biotechnological applications are discussed. (.25 ED/.75 ES) C-L: Civil and Environmental Engineering 207 and Mechanical Engineering 207. One course. *Bryers, Daniels, or Truskey*

**211. Theoretical Electrophysiology.** Advanced topics on the electrophysiological behavior of nerve and striated muscle. Source-field models for single-fiber and fiber bundle lying in a volume conductor. Forward and inverse models for EMG and ENG. Bidomain model. Model and simulation for stimulation of single-fiber and fiber bundle. Laboratory exercises based on computer simulation, with emphasis on quantitative behavior and design. Readings from original literature. (.5 ED/.5 ES) Prerequisite: Biomedical Engineering 101 or 201. One course. *Barr and Plonsey*

**212. Theoretical Electrocardiography.** Electrophysiological behavior of cardiac muscle. Emphasis on quantitative study of cardiac tissue with respect to propagation and the evaluation of sources. Effect of junctions, inhomogeneities, anisotropy, and presence of unbounded extracellular space. Bidomain models. Study of models of arrhythmia, fibrillation, and defibrillation. Electrocardiographic models and forward simulations. Laboratory exercises based on computer simulation, with emphasis on quantitative behavior and design. Readings from original literature. (.5 ED/.5 ES) Prerequisite: Biomedical Engineering 101 or 201. One course. *Barr and Plonsey*

**215. Biomedical Materials and Artificial Organs.** Chemical structures, processing methods, evaluation procedures, and regulations for materials used in biomedical applications. Applications include implant materials, components of ex vivo circuits, and cosmetic prostheses. Primary emphasis on polymer-based materials and on optimization of parameters of materials which determine their utility in applications such as artificial kidney membranes and artificial arteries. (.5 ED/.5 ES) Prerequisite: Engineering 83 or Chemistry 151 or consent of instructor. C-L: Mechanical Engineering 215. One course. *Clark*

**216. Transport Phenomena in Cells and Organs.** Applications of the principles of mass and momentum transport to the analysis of selected processes of biomedical and biotech-

nological interest. Emphasis placed on the development of critical analysis of models of the particular transport process. Topics discussed include: reaction-diffusion processes, transport in natural and artificial membranes, dynamics of blood flow, pharmacokinetics, receptor-mediated processes and macromolecular transport, normal and neoplastic tissue. (.5 ED/.5 ES) Prerequisite: Biomedical Engineering 207 or equivalent. One course. *Truskey*

**222. Principles of Ultrasound Imaging.** Propagation, reflection, refraction, and diffraction of acoustic waves in biologic media. Topics include geometric optics, physical optics, attenuation, and image quality parameters such as signal-to-noise ratio, dynamic range, and resolution. Emphasis is placed on the design and analysis of medical ultrasound imaging systems. (.5 ED/.5 ES) Prerequisites: Physics 52 and Mathematics 111. One course. *von Ramm*

**230. Biomechanics.** Basic elements of mechanics are developed with application in biomechanics. Primary emphasis is given to trauma mechanisms, injury criteria, and human protection. Head and neck injuries and helmet design are discussed. Case studies from product liability lawsuits with a strong biomechanics context are discussed in a seminar mode. (.5 ED/.5 ES) One course. *McElhaney*

**233. Modern Diagnostic Imaging Systems.** The underlying concepts and instrumentation of several modern medical imaging modalities. Review of applicable linear systems theory and relevant principles of physics. Modalities studied include X-ray radiography (conventional film-screen imaging and modern electronic imaging), computerized tomography (including the theory of reconstruction), and nuclear magnetic resonance imaging. (.5 ED/.5 ES) Prerequisite: consent of instructor. One course. *Cusma or Floyd*

**235. Acoustics and Hearing.** The generation and propagation of acoustic (vibrational) waves and their reception and interpretation by the auditory system. Topics under the heading of generation and propagation include free and forced vibrations of discrete and continuous systems, resonance and damping, and the wave equation and solutions. So that students may understand the reception and interpretation of sound, the anatomy and physiology of the mammalian auditory system are presented; and the mechanics of the middle and inner ears are studied. (.5 ED/.5 ES) Prerequisites: Physics 52 and Mathematics 111 or equivalents. One course. *Trahey*

**241. Artificial Intelligence in Medicine.** Basic concepts of artificial intelligence (AI) and in-depth examination of medical applications of AI. Knowledge of heuristic programming; brief examination of classic AI programming languages (LISP and PROLOG) and AI programming; rule-based systems and cognitive models. (.5 ED/.5 ES) One course. *Hammond*

**243. Computers in Biomedical Engineering.** An in-depth study of the use of computers in biomedical applications. Hardware, software, and applications programming. Data collection, analysis, and presentation studied within application areas such as monitoring, medical records, computer-aided diagnoses, computer-aided instruction, M.D.-assistance programs, laboratory processing, wave form analysis, hospital information systems, and medical information systems. (.5 ED/.5 ES) One course. *Hammond*

**265. Advanced Topics in Biomedical Engineering.** Advanced subjects related to programs within biomedical engineering tailored to fit the requirements of a small group. (.5 ED/.5 ES) Prerequisite: consent of instructor. One course. *Staff*

## COURSES CURRENTLY UNSCHEDULED

**204. Measurement and Control of Cardiac Electrical Events**

## THE MAJOR

The major requirements are included in the minimum total of thirty-four courses listed under general requirements and departmental requirements. The following specific courses must be included: Biomedical Engineering 101, 110, 163, 164, and 207.

### Civil and Environmental Engineering (CE)

Professor Vesilind, *Chairman*; Associate Professor Pas, *Director of Undergraduate Studies*; Professors Haff, Melosh, Petroski, S. Utku, and J. F. Wilson; Associate Professors Biswas, Bryers, Hueckel, Medina, Peirce, and Reckhow; Assistant Professor Faust; Adjunct Professors Kranich and Saibel; Adjunct Associate Professor B. Utku

A civil engineering major is available in this department.

Civil and environmental engineering is one of the broadest of the engineering disciplines, extending across mathematics and the natural sciences, including physics, biology, and chemistry, and emphasizing the social and management sciences. Civil and environmental engineers develop expertise in these disciplines to research, plan, design, and construct solutions to problems faced in modern life by both the public and private sectors. These solutions vary widely in nature, size, and scope; space satellites and launching facilities, offshore structures, environmental controls to protect public health, nuclear and conventional power stations, bridges, dams, buildings, tunnels, highways, and mass transportation systems.

Seven major specialty areas at Duke enjoy national and international reputations for quality at both the undergraduate and graduate levels of study:

- environmental engineering: hazardous waste disposal, solid waste processing, biotechnology, and water supply and wastewater treatment to protect public health and the environment;
- mechanics: the behavior of solid and fluid materials under selected conditions of loading and environment;
- structural engineering: the economical and safe design of engineered structures;
- urban and regional engineering: a broad spectrum of integrated land and city planning and transportation system planning and engineering;
- water resources: the use, preservation, and management of surface and ground-water supplies;
- geotechnical engineering: the interaction between structures and the supporting soil and rock;
- architectural engineering: interaction between engineering design and artistic representation of structures.

In addition, students may elect a general program in civil and environmental engineering studies, and/or pursue a degree with a double major in civil engineering and another department at Duke. The list of recently completed double majors indicates the diversity and breadth of interests shared by civil and environmental engineers: public policy studies, economics, business, French, and music. Students also may obtain the BSE and MBA degrees in five years through a special program of study.

The Civil and Environmental Program at Duke is supported by prominent faculty as well as modern laboratory and instructional facilities. The professors in the Department of Civil and Environmental Engineering are committed to quality classroom lectures and laboratory experiences in settings which encourage student-student and student-faculty interactions. The same professors conduct research of national and international consequence.

Laboratory facilities in the Department are comparable to those found in other major universities. For example, computers are relied upon for data collection and analysis. Chemical and biological testing apparatus are utilized in the laboratory for teaching and research activities, and electronic measurement equipment is designed, constructed, and applied in many of the specialty areas mentioned above.



Students in the Department of Civil and Environmental Engineering may spend their junior year studying at University College London. Courses taken under this program will be graded and counted toward the Duke BSE degree. Applications should be made through the Director of Undergraduate Studies in the department.

Recent graduates from the Department of Civil and Environmental Engineering have selected from a wide range of possible career paths. Graduate study in engineering or in such fields as business and architecture is often pursued by Duke graduates. Many other graduates accept positions with major corporations as well as federal, state, and local government agencies as design engineers and project managers.

**101. Structural Engineering in Perspective.** How structures work, and why they sometimes fail. An introduction to the engineering method, especially as applied to the design and analysis of civil engineering structures. Open to engineering and nonengineering students alike. (.5 ED/.5 ES) Prerequisite: consent of instructor. One course. *Petroski*

**116. Transportation Engineering.** The role and history of transportation. Introduction to the planning and design of multimodal transportation systems. Principles of traffic engineering and route location and design. Planning studies and economic evaluation. (.5 ED/.5 ES) Prerequisites: junior or senior standing and consent of instructor for nonengineering students. One course. *Pas*

**122. Fluid Mechanics.** Physical properties of fluids; fluid-flow concepts and basic equations; continuity, energy, and momentum principles; dimensional analysis and dynamic similitude; viscous effects; applications emphasizing real fluids. Selected laboratory work. (1.0 ES) Corequisite: Engineering 123. One course. *Medina*

**123. Water Resources Engineering.** Descriptive and quantitative hydrology, hydraulics of pressure conduits and measurement of flow, compound pipe systems, analysis of flow in pressure distribution systems, open channel flow, reservoirs and distribution system storage. Groundwater hydrology and well-hydraulics. Probability and statistics in water resources. Selected laboratory and field exercises, computer applications. (.15 ED/.85 ES) Prerequisite: Civil Engineering 122. One course. *Medina*

**124. Environmental Engineering.** Qualitative and quantitative physical, chemical, and bacteriological characterization of water and wastewater. Introduction to water treatment processes and wastewater collection, treatment and disposal systems. Air pollution control; solid and hazardous waste management. Laboratory included. Field trips to be arranged. (.75 ED/.25 ES) Prerequisite: Civil Engineering 123. One course. *Bryers, Peirce, or Vesilind*

**127. Environmental Pollution Control.** A study of the environmental causes and effects of air, land, and water pollution. Interactions between the environment and stresses to which it is subjected as a consequence of growth and concentration of populations and their increasing demands on natural resources. Solid waste, recycling, noise pollution, and environmental ethics. Not open to engineering majors. (1.0 ES) One course. *Peirce or Vesilind*

**131. Theory of Structures.** Application of mechanics to the analysis of plane and space structures; a unified treatment of statically determinate and indeterminate structural systems. (.15 ED/.85 ES) Prerequisites: Mathematics 103 and Engineering 75. One course. *Biswas or Melosh*

**133. Structural Design I.** Nonhomogenous materials. Determination of physical and mechanical properties of construction materials. Theory and design of compression and flexural members. Emphasis on ultimate strength theory for concrete. Timber design using mechanical fasteners. Laboratory exercises include concrete aggregate evaluation, concrete mix design, and structural timber tests. (1.0 ED) Prerequisite: Civil Engineering 131. One course. *Biswas*

**134. Structural Design II.** Design in metals, primarily steel. Properties of materials as criteria for failure. Tension, compression, and flexural members. Bolted and welded connections, including eccentric connections. Built-up members. Design by elastic and plastic methods. Selected problems to include computations and drawings. (1.0 ED) Prerequisite: Civil Engineering 131. One course. *Biswas or Melosh*

**139. Introduction to Soil Mechanics.** Origin and composition of soils, soil structure. Flow of water through soils; capillary and osmotic phenomena. Soil behavior under stress; compressibility, shear strength. Elements of mechanics of soil masses with application to problems of bearing capacity of foundations, earth pressure on retaining walls, and stability of slopes. Laboratory included. (.5 ED/.5 ES) Prerequisite: Civil Engineering 122. One course. *Hueckel*

**141, 142. Special Topics in Civil Engineering.** Study arranged on a special topic in which the instructor has particular interest and competence. Half course or one course each. Prerequisites: consent of instructor and Director of Undergraduate Studies. Variable credit. *Staff*

**161. Architectural Engineering I.** Analysis of the building through the study of its subsystems (enclosure, space, structural, environmental-control). Building materials and their principal uses in the enclosure and structural subsystems. System and material selection studies. (.5 ED/.5 ES) Prerequisite: Engineering 75 or consent of instructor. One course. *B. Utku*

**162. Architectural Engineering II.** Design and integration of building subsystems (enclosure, space, structural, environmental-control) in the design of a medium-size building. (1.0 ED) Prerequisite: Civil Engineering 161 or consent of instructor. One course. *B. Utku*

**197, 198. Projects in Civil Engineering.** These courses may be taken by junior and senior engineering students who have demonstrated aptitude for independent work. Half course or one course each. Prerequisites: consent of instructor and Director of Undergraduate Studies. Variable credit. *Staff*

**201. Advanced Mechanics of Solids.** Tensor fields and index notation. Analysis of states of stress and strain. Conservation laws and field equations. Constitutive equations for elastic, viscoelastic, and elastic-plastic solids. Formulation and solution of simple problems in elasticity, viscoelasticity, and plasticity. (1.0 ES) One course. *Hueckel or Petroski*

**203. Plasticity.** Inelastic behavior of soils and engineering materials. Yield criteria. Flow rules. Concepts of perfect plasticity and plastic hardening. Methods of rigid-plasticity. Limit analysis. Isotropic and kinematic hardening. Plastic softening. Diffused damage. Thermo-plasticity. Visco-plasticity. (1.0 ES) Prerequisite: Civil and Environmental Engineering 201 or consent of instructor. One course. *Hueckel*

**204. Plates and Shells.** Differential equation and extremum formulations of linear equilibrium problems of Kirchhoffian and non-Kirchhoffian plates of isotropic and orthotropic material. Solution methods. Differential equation formulation of thin shell problems in curvilinear coordinates; membrane and bending theories; specialization for shallow shells, shells of revolution, and plates. Extremum formulation of shell problems. Solution methods. (1.0 ES) Prerequisites: Mathematics 111 and Engineering 75 or 135. One course. *Utku*

**205. Elasticity.** Introduction to linear theory of elasticity. Constitutive equations for anisotropic and isotropic elastic solids. Formulation and solution of torsion, bending, and flexure problems. Plane, axisymmetric, and three-dimensional problems. (1.0 ES) One course. *Petroski*

**207. Transport Phenomena in Biological Systems.** (.25 ED/.75 ES) See C-L: Biomedical Engineering 207; also C-L: Mechanical Engineering 207. One course. *Bryers, Daniels, or Truskey*

**210. Intermediate Dynamics.** Comprehensive treatment of space kinematics, kinetics of particles and rigid bodies; generalized coordinates and Lagrange's equations; introduction to stability, nonlinear, and random dynamic analysis of flexible, continuous systems. (.25 ED/.75 ES) C-L: Mechanical Engineering 210. One course. *Dowell*

**212. Mechanical Behavior and Fracture of Materials.** Historical perspective on structural failure. Fracture mechanics and its application to brittle and ductile fracture, and fatigue in structural materials. Analysis of load spectra; fatigue crack growth calculations. (.25 ED/.75 ES) One course. *Petroski*

**215. Engineering Systems Analysis.** Fundamental concepts and tools for engineering systems analysis, including optimization techniques and decision analysis. System definition and model formulation, optimization by calculus, linear programming, integer programming, separable integer programming, nonlinear programming, network analysis, dynamic programming, and decision analysis. Application to diverse engineering systems. (.25 ED/.75 ES) One course. *Pas*

**216. Transportation Planning and Policy Analysis.** Issues in policy planning and decision making in urban and rural transportation systems. Transportation legislation. Public transportation alternatives with emphasis on public transit and paratransit solutions. (1.0 ES) Prerequisite: (or corequisite) Civil and Environmental Engineering 116 or consent of instructor. C-L: Public Policy Studies 254. One course. *Pas*

**217. Transportation Systems Analysis.** The transportation systems planning process. Quantitative analysis; mathematical modeling and computer simulation techniques for short- and long-range planning and evaluation of transportation systems. (1.0 ES) Prerequisite: (or corequisite) Civil and Environmental Engineering 116 or consent of instructor. One course. *Pas*

**218. Engineering Management and Project Evaluation.** Statistical analysis and economics. Data organization, distributions, estimates of parameters, hypothesis testing, analysis of variance. Economic impact assessment, supply and demand forecasting, benefit/cost analysis, economic incentives, public and private finance, input/output analysis. (1.0 ES) One course. *Peirce*

**225. Dynamic Engineering Hydrology.** Dynamics of the occurrence, circulation, and distribution of water; hydrometeorology, geophysical fluid motions. Precipitation, surface runoff and stream flow, infiltration, water losses. Hydrograph analysis, catchment characteristics, hydrologic instrumentation, and computer simulation models. (1.0 ES) Prerequisite: Civil and Environmental Engineering 122 or consent of instructor. One course. *Medina*

**227. Groundwater Hydrology and Contaminant Transport.** Review of surface hydrology and its interaction with groundwater. The nature of porous media, hydraulic conductivity, and permeability. General hydrodynamic equations of flow in isotropic and anisotropic media. Water quality standards and contaminant transport processes: advective-dispersive equation for solute transport in saturated porous media. Analytical and numerical methods, selected computer applications. Deterministic versus stochastic models. Applications: leachate from sanitary landfills, industrial lagoons and ponds, subsurface wastewater injection, monitoring of groundwater contamination. Conjunctive surface-subsurface models. (.1 ED/.9 ES) Prerequisite: Civil and Environmental Engineering 123 or consent of instructor. One course. *Medina*

**233. Prestressed Concrete Design.** A critical review of research and recent developments in prestressed concrete design. Prestressed tanks, beams, and columns; partial



prestressing and composite design. (1.0 ED) Prerequisite: Civil and Environmental Engineering 133. One course. *Biswas*

**235. Foundation Engineering.** An introduction to methods of analysis, design, and construction of foundations. Bearing capacity and settlement of shallow and deep foundations. Soil exploration, excavation and bracing, drainage and stabilization, and underpinning. Foundation vibrations. (1.0 ED) Prerequisite: Civil Engineering 139. One course. *Hueckel*

**237. Advanced Soil Mechanics.** Characterization of behavior of geomaterials. Stress-strain incremental laws. Nonlinear elasticity, hypo-elasticity, plasticity and visco-plasticity of geomaterials; approximated laws of soil mechanics; fluid-saturated soil behavior; cyclic behavior of soils; liquefaction and cyclic mobility; elements of soil dynamics; thermal effects on soils. (1.0 ES) Prerequisite: Civil and Environmental Engineering 139 or equivalent. One course. *Hueckel*

**240. Fate of Organic Chemicals in the Environment.** Kinetic, equilibrium, and analytical approaches applied to quantitative description of processes affecting the fate of anthropogenic and natural organic compounds in ground, surface, and atmospheric waters, and in selected treatment processes, including sorption phenomena, gas transfer, hydrolysis, photochemistry, oxidation-reduction, and biodegradation. Sampling, detection, identification, and quantification of organic compounds in the environment. Gas and liquid chromatography and mass spectrometry. (1.0 ES) Corequisite: Civil Engineering 242 or equivalent. Spring, odd-numbered years. C-L: Forestry and Environmental Studies 240. One course. *Dubay and Faust*

**242. Environmental Chemistry.** Principles of chemical kinetics and equilibria applied to quantitative description of the chemistry of lakes, rivers, oceans, atmospheric waters, groundwaters, and selected treatment processes. Equilibrium, steady state and other kinetic models applied to processes such as the carbonate system, coordination chemistry, precipitation and dissolution, oxidation-reduction, photochemistry, heterogeneous reactions, gas transfer, and some aspects of atmospheric chemistry. Spring. (1.0 ES) C-L: Forestry and Environmental Studies 242. One course. *Faust*

**243. Physicochemical Unit Operations in Water Treatment.** Fundamental bases for design of water and waste treatment systems, including transport, mixing, sedimentation and filtration, gas transfer, coagulation, and biotreatment processes. (.25 ED/.75 ES) Prerequisite: Engineering 24 or Civil and Environmental Engineering 124. One course. *Bryers or Vesilind*

**244. Applied Microbial Processes.** Existing and novel biological processes used to treat or exploit waste. Concepts of microbiology, chemical engineering, and process analysis. Specific biological processes such as aerobic carbon oxidation, nitrification, denitrification, methane production, biological electricity generation, aerobic digestion, and wastewater treatment for long term space travel. (.25 ED/.75 ES) One course. *Bryers*

**245. Pollutant Transport Systems.** Distribution of pollutants in natural waters and the atmosphere; diffusive and advective transport phenomena within the natural environment and through artificial conduits and storage/treatment systems. Analytical and numerical prediction methods. (.1 ED/.9 ES) Prerequisites: Civil and Environmental Engineering 122 and Mathematics 111 or equivalents. One course. *Medina*

**246. Water Supply Engineering Design.** The study of water resources and municipal water requirements including reservoirs, transmission, treatment and distribution systems; methods of collection, treatment, and disposal of municipal and industrial wastewaters. The course includes the preparation of a comprehensive engineering report encompassing all aspects of municipal water and wastewater systems. Field trips to be arranged. (1.0 ED) Prerequisite: Engineering 24 or Civil and Environmental Engineering 124 or consent of instructor. One course. *Vesilind*

**248. Solid Waste and Resource Recovery Engineering.** Engineering design of resource recovery systems including traditional and advanced technologies. Sanitary landfills and incineration of solid wastes. Energy recovery and recycling processes. Application of systems analysis to collection of municipal refuse. Collection, treatment, and disposal of solid wastes from wastewater treatment. (1.0 ED) Prerequisite: Engineering 24 or Civil Engineering 124. One course. *Vesilind*

**249. Control of Hazardous and Toxic Waste.** Engineering solutions to industrial and municipal hazardous waste management problems. Handling, transportation, storage, and disposal technologies. Biological, chemical, and physical processes. Upgrading an abandoned disposal site. Economic and regulatory aspects. Case studies. (.25 ED/.75 ES) Prerequisite: consent of instructor. One course. *Peirce*

**251. Systematic Engineering Analysis.** Mathematical formulation and numerical analysis of discrete engineering systems with emphasis on theory of structures. Equilibrium and propagation problems in continuum; properties of these systems and their discretization by the trial functions with undetermined parameters. The use of weighted residual methods, finite elements, and finite differences. (1.0 ES) Prerequisite: senior or graduate standing. One course. *S. Utku*

**254. Applications of Finite Element Analysis.** Theory of element and material models; models of metals, rock, reinforced concrete, wood, glass, soil, water, and air; analyses of torsion members, shear walls, membranes, plates, shells, solids, and compound structural systems; analysis of soil-structure and fluid-structure systems; prediction of field heating, seepage, and pollution. (.1 ED/.9 ES) Prerequisite: Civil and Environmental Engineering 251 or consent of instructor. One course. *Melosh*

**257. Structural Optimization.** Computer-aided improvement of structural designs; redesign search processes, sensitivity analysis, integrity analysis; optimization of static, steady-state, and transient response systems; minimization of structural weight and response potentials for trusses, frames, and continua. (.65 ED/.35 ES) One course. *Melosh*

**258. Analysis of Dynamic and Nonlinear Behavior of Structures.** Computation of nonlinear response by discretization; models for simulation of geometric, material, and boundary constraint nonlinearities; analysis of limit loads, bifurcations, and snap-through; simulation of super-elastic, plastic, visco-elastic, and slipping materials; prediction of collapsing, ballooning, gapping, metal forming, and welding behavior. (1.0 ES) Prerequisite: Civil and Environmental Engineering 251 or consent of instructor. One course. *Melosh or S. Utku*

**265. Advanced Topics in Civil and Environmental Engineering.** Opportunity for study of advanced subjects relating to programs within the civil and environmental engineering department tailored to fit the requirements of a small group. One course. *Staff*

**281. Experimental Systems.** Formulation of experiments; Pi theorem and principles of similitude; data acquisition systems; static and dynamic measurement of displacement, force, and strain; interfacing experiments with digital computers for data storage, analysis, and plotting. Students select, design, perform, and interpret laboratory-scale experiments in areas of fluid systems including environmental engineering, and in solid systems including structural and basic material behavior. (.3 ED/.7 ES) Prerequisite: senior or graduate standing in engineering or the physical sciences. One course. *J. F. Wilson*

**283. Structural Dynamics.** Formulation of dynamic models for discrete and continuous structures, normal mode analysis, deterministic and stochastic responses to shocks and environmental loading (earthquakes, winds, and waves), introduction to nonlinear dynamic systems, analysis and stability of structural components (beams and cables and large systems such as offshore towers, moored ships, and floating platforms). (1.0 ES) One course. *J. F. Wilson*

## COURSES CURRENTLY UNSCHEDULED

- 202. Advanced Mechanics of Solids II
- 226. Operational Hydrology
- 232. Reinforced Concrete Design
- 234. Advanced Structural Design in Metals
- 236. Earth Structures
- 238. Rock Mechanics
- 239. Physical Properties of Soils
- 247. Air Pollution Control

## THE MAJOR

The major requirements are included in the minimum total of thirty-four courses listed under the general requirements and departmental requirements.

## Electrical Engineering (EE)

Professor Casey, *Chairman*; Associate Professor Hacker, *Director of Undergraduate Studies*; Professors Fair, Joines, Kerr, Marinos, Nolte, Pilkington, Trivedi, Wang, and T. G. Wilson; Associate Professors Dugan, Kedem, and Massoud; Assistant Professors Alexandrou, Board, Dollas, George, Hansen, and Wong; Professor Emeritus Owen; Research Assistant Professor Frenzel; Adjunct Professors Glomb and Strosco; Adjunct Associate Professors Derby and Rebman; Adjunct Assistant Professors Goodwin-Johansson, Kanopoulos, Loeb, and Strole; Visiting Professor Trickey

A major is available in this department.

Electrical engineering is a broadly based discipline dealing with the processing, control, and transmission of information and energy by making use of electrical and electromagnetic phenomena.

The flexibility of the electrical engineering curriculum permits students to concentrate in such areas as computer engineering and digital systems, control systems, electronic circuits and microelectronics, signal processing and communications, and electromagnetic fields and microwaves. Students may also plan a double-major program with secondary concentration in such fields as computer science, biomedical engineering, physics, mathematics, history, public policy studies, and many others. Students with interests such as premedicine, prelaw, economics, art, music, psychology, and social systems can be accommodated within the curriculum through individually designed programs.

The various teaching and research laboratories in the department provide opportunities for laboratory and project work in areas such as electronics, digital systems, microelectronics and microprocessors, signal analysis and adaptive signal processing, power electronics, microwaves and microwave-matter interactions, and solid-state properties of materials. These laboratories are important to the undergraduate program since they permit students to become actively acquainted with the devices and techniques of modern electrical engineering through regularly scheduled experiments, independent projects, and occasionally, part-time assistance to faculty members engaged in research.

**51, 52. Undergraduate Research in Electrical Engineering.** An elective program in which undergraduate students participate in an ongoing program of research with electrical engineering faculty members. The research topic to be pursued by the student must be discussed with, and approved by, the faculty member who is to serve as the research supervisor prior to registration for the course. For sophomores only. Half course each. *Staff*



**61. Introductory Circuits and Systems.** Circuit principles for linear and nonlinear networks, common signal waveforms, natural and forced response of linear circuits. Circuits in the AC steady state. One-port and two-port network theorems, transfer functions, block diagrams, feedback. Semiconductor diodes, transistors, and integrated circuits. (.25 ED/.75 ES) Prerequisites: Mathematics 32 and Physics 51. One course. *Staff*

**62. Introductory Electronics and Energy Conversion.** Amplifiers: biasing circuits, large-signal diode and transistor models, small-signal multistage and feedback amplifiers. Operational amplifiers and analog computers. Energy conversion via magnetic fields and circuits. Transformers, DC and AC machines, instrumentation, and automatic control. (.25 ED/.75 ES) Prerequisite: Electrical Engineering 61. One course. *Staff*

**101, 102. Undergraduate Research in Electrical Engineering.** For juniors only. See Electrical Engineering 51, 52. Half course each. *Staff*

**103. Introduction to Nonlinear Network Theory.** Introduction to theory and techniques for analysis and synthesis of nonlinear circuits. Characterization of 2-, 3-, and n-terminal nonlinear network elements. Laws for interconnecting elements and determining equilibrium equations. Operating points, driving-point and transfer-characteristic plots. Graphical and numerical analysis and synthesis of DC and AC nonlinear resistive functional networks. Nonautonomous first-order nonlinear networks, and autonomous second-order nonlinear networks. Some laboratory and computer simulations. (.5 ED/.5 ES) Prerequisite: Electrical Engineering 61. One course. *T. G. Wilson*

**112. Fundamentals of Linear System Theory.** Fourier series and transforms; spectral analysis applied to networks and modulation systems. Laplace transforms and transient response of systems; transfer functions, poles and zeros, stability. Introduction to Z-transforms and state variable models. (1.0 ES) Prerequisite: Electrical Engineering 61. One course. *Staff*

**132. Statistical and Computational Methods in Signal Processing.** Introduction to fundamental concepts of signal processing for both deterministic and random discrete-time signals in noise. Difference equations, sampling theorem, Z-transforms, and spectral analysis. Detection and estimation of signals in noise. Some computer simulations. (.5 ED/.5 ES) Prerequisites: Biomedical Engineering 171 or Electrical Engineering 112 and Mathematics 135 or equivalent. C-L: Biomedical Engineering 132. One course. *Nolte*

**142. Thermodynamics of Electrical Processes.** A study of those aspects of classical and statistical thermodynamics that are essential for an understanding of the thermal properties of electrical materials and processes. Emphasis will be placed on the thermodynamics of metals, semiconductors, and superconductors. (1.0 ES) Prerequisites: Electrical Engineering 112 and Mathematics 104 or 111. One course. *Hacker*

**143. Introduction to Electromagnetic Fields.** Review of vector analysis. Introduction to Maxwell's equations. Electrostatic and magnetostatic fields and their sources. Electromagnetic power, energy, and the Poynting theorem. (.25 ED/.75 ES) Prerequisites: Mathematics 104 or 111 and Physics 52. One course. *Hacker or Joines*

**151, 152. Undergraduate Research in Electrical Engineering.** For seniors only. See Electrical Engineering 51, 52. Half course or one course each. Variable credit. *Staff*

**155, 156. Special Topics in Electrical Engineering.** Study of selected topics in electrical engineering tailored to fit the requirements of a small group. Half course or one course each. Prerequisites: consent of instructor and Director of Undergraduate Studies. Variable credit. *Staff*

**157. Introduction to Switching and Automata Theory.** This course introduces techniques for the analysis and design of combinational and sequential networks. Discrete mathematical systems, elements of code theory, threshold logic, functional decomposi-

tion, minimum-complexity combinational and sequential networks, asynchronous and clocked sequential systems, iterative switching structures, Turing machines, fault diagnosis techniques. Selected laboratory work. Usually open to juniors and seniors. (.25 ED/.75 ES) C-L: Computer Science 157. One course. *Strole*

**160. Digital Electronics and Computer Hardware.** The basics of DC and AC circuit analysis, digital circuitry, MOS devices and hybrid designs, timing considerations. Switching characteristics of transistors and simple amplifier circuits. Speed, power, fanin and fanout, and cost as a basis of comparison of different logic families. Applications to digital system design. Not open to biomedical or electrical engineering majors. (.25 ED/.75 ES) Prerequisite: Physics 52. C-L: Computer Science 160. One course. *Dollas or Dugan*

**161. Electronic Circuits.** Graphical and mathematical modeling of electronic devices such as diodes, and bipolar-junction and field-effect transistors; techniques for the analysis and design of electronic circuits with emphasis on large-signal and small-signal methods; applications of these methods to particular circuits, including regulators, bias-point stability, amplifiers, and switching circuits; computer simulation of electronic circuits using SPICE. Three class sessions and one computation or laboratory session. (.75 ED/.25 ES) Prerequisite: Electrical Engineering 112. One course. *George*

**162. Advanced Analog Electronic Circuits.** Feedback and operational amplifiers: a study of feedback analysis, stability design, circuits; bipolar junction transistor and MOS operational amplifier analyses, stability techniques, noise, and other topics. Laboratory and computer simulation work. (.75 ED/.25 ES) Prerequisite: Electrical Engineering 161. One course. *Derby and George*

**173, 174. Projects in Electrical Engineering.** A course which may be undertaken only by seniors who are enrolled in the graduation with distinction program or who show special aptitude for individual project work. Elective for electrical engineering majors. Half course to two courses each. Prerequisite: consent of Director of Undergraduate Studies. Variable credit. *Staff*

**186. Fundamentals of Signal Processing and Communications.** The fundamentals of signal representation and system characterization used in digital signal processing and communications. Linear time-invariant systems and sampling theory. Probability: random variables, probability density functions, expectation, moments, auto and cross-correlation, transformation of random variables. Communication systems: basic concepts in amplitude modulation, frequency division multiplexing, amplitude shift keying, pulse code modulation, matched filtering. Discrete-time signal processing: discrete-time systems, response with noisy excitation, introduction to digital filter design, discrete Fourier transform, fast Fourier transform. Applications to areas such as image, sonar/radar, or speech. (.25 ED/.75 ES) Prerequisites: Electrical Engineering 112 and Mathematics 135 or Statistics 200, or consent of instructor. One course. *Alexandrou, Hansen, Kerr, or Nolte*

**187. Digital Telecommunications.** Examination of existing telephone networks in the U.S. with emphasis on the transition from analog to digital systems. Sequential processes of encoding, transmission, switching, and network hierarchy. Consideration of the problems which must be solved in the transition from analog to digital networks. (.5 ED/.5 ES) Prerequisite: Electrical Engineering 186. One course. *Glomb*

**199. Linear Control Systems.** Analysis and design of feedback control systems. Block diagram and signal flow graph system models. Servomechanism characteristics, steady-state errors, sensitivity to parameter variations and disturbance signals. Time domain performance specifications. Stability. Root locus, Nyquist, and Bode analysis; design of compensation circuits; closed loop frequency response determination. Introduction to time domain analysis and design. (.5 ED/.5 ES) Prerequisite: Electrical Engineering 112 or consent of instructor. One course. *Kerr or T. G. Wilson*

**201. Digital Processing of Speech Signals.** Detailed treatment of the theory and application of digital speech processing. Modeling of the speech production system and speech signals; speech processing methods; digital techniques applied in speech transmission, speech synthesis, speech recognition, and speaker verification. Acoustic-phonetics, digital speech modeling techniques, LPC analysis methods, speech coding techniques. Application case studies: synthesis, vocoders, DTW (dynamic time warping)/HMM (hidden Markov modeling) recognition methods, speaker verification/identification. (.25 ED/.75 ES) Prerequisite: Electrical Engineering 206 or equivalent or consent of instructor. One course. *Hansen*

**202. Digital Communication Systems.** Transmission of pulse signals over analog channels at baseband and high frequency. Effects of channel amplitude and phase distortion, multipath, and noise. Typical signaling formats and their autocorrelation functions and power spectra. Theory and design of adaptive transversal filters for the elimination of intersymbol interference. Design of digital transversal matched filters to reduce error probabilities in the presence of noise. Optimum pulse shaping techniques and Nyquist channel characteristics. Discrete Fourier transforms, FFTs, and their relation to continuous Fourier transforms. Introduction to the channel characteristics and sources of noise in optical fiber channels. (.5 ED/.5 ES) Prerequisites: Electrical Engineering 186 and Mathematics 135 or Electrical Engineering 203, or consent of instructor. One course. *Kerr*

**203. Random Signals and Noise.** Introduction to mathematical methods of describing and analyzing random signals and noise. Review of basic probability theory; joint, conditional, and marginal distributions; random processes. Time and ensemble averages, correlation, and power spectra. Optimum linear smoothing and predicting filters. Introduction to optimum signal detection and parameter estimation. (1.0 ES) One course. *Kerr or Nolte*

**204. Computer Network Architecture.** The architecture of computer communication networks and the hardware and software required to implement the protocols that define the architecture. Basic communication theory, transmission technology, private and common carrier facilities. International standards. Satellite communications and local area networks. Performance analysis and modeling of communication networks. (.25 ED/.75 ES) Prerequisite: Electrical Engineering 157. C-L: Computer Science 204. One course. *Strole*

**205. Signal Detection and Extraction Theory.** Introduction to signal detection and information extraction theory from a statistical decision theory viewpoint. Subject areas covered within the context of a digital environment are decision theory, detection and estimation of known and random signals in noise, estimation of parameters and adaptive recursive digital filtering, and decision processes with finite memory. Applications to problems in communication theory. (.5 ED/.5 ES) Prerequisite: Electrical Engineering 203 or consent of instructor. One course. *Nolte*

**206. Digital Signal Processing.** Introduction to the fundamentals of processing signals by digital techniques with applications to practical problems. Discrete time signals and systems, elements of the Z-transform, discrete Fourier transforms, digital filter design techniques, fast Fourier transforms, and discrete random signals. (.5 ED/.5 ES) One course. *Nolte*

**207. Fault-Tolerant and Testable Computer Systems.** Faults and failure mechanisms, test generation techniques and diagnostic program development for detection and location of faults in digital networks; design for testability, redundancy techniques, self-checking and fail-safe networks, fault-tolerant computer architectures. (.5 ED/.5 ES) Prerequisite: Electrical Engineering 157 or equivalent. C-L: Computer Science 207. One course. *Marinos*



**208. Digital Computer Architecture and Design.** Structural organization and hardware design of digital computer systems. Arithmetic unit, switching matrices, memory organization, central processing unit (CPU), I/O unit, and microprogram control. Detailed design and simulation of a general-purpose computer system. Computer systems based on cellular structures, hardware compilers, and parallel processing architectures are also discussed. (.75 ED/.25 ES) Prerequisites: Electrical Engineering 157 and Computer Science 104 or consent of instructor. C-L: Computer Science 208. One course. *Marinos*

**209. Microprocessor Fundamentals and Applications.** Various state-of-the-art microprocessor chips and their associated instruction sets; microcomputer architectures; comparative study of various microprocessor designs; microprocessor-based system design illustrated by several carefully selected design projects. (.5 ED/.5 ES) Prerequisites: Electrical Engineering 157 and consent of instructor. C-L: Computer Science 209. One course. *George*

**210. Introduction to VLSI Systems.** A first course in VLSI design with CMOS technologies. A study of devices, circuits, fabrication technology, logic design techniques, subsystem design and system architecture. Modeling of circuits and subsystems. Testing of gates, subsystems and chips, and design for testability. The fundamentals of full-custom design, and some semi-custom design. Prerequisites: logic design (Computer Science/Electrical Engineering 157 or equivalent), and electronics (EE 161, or CPS/EE 160, or equivalent). C-L: Computer Science 210. One course. *Dollas or Kedem*

**211. Quantum Mechanics.** Wave mechanics and elementary applications, free particle motion, Schrödinger equation, approximation methods. (1.0 ES) One course. *Staff*

**213. Modern Optics.** Optical processes including the propagation of light, coherence, interference, and diffraction. Consideration of the optical properties of solids with applications of these concepts to lasers and modern optical devices. (.25 ED/.75 ES) C-L: Physics 185. One course. *Guenther or Hacker*

**214. Introduction to Solid-State Physics.** Discussion of solid-state phenomena including crystalline structures, thermal properties, free electron theory of metals, and band theory of semiconductors with emphasis on understanding the electrical, magnetic, and optical properties of solids. (.25 ED/.75 ES) Prerequisite: Physics 161 or equivalent. C-L: Physics 214. One course. *Hacker*

**216. Devices for Integrated Circuits.** Basic operating concepts of the devices that are used in integrated circuits: Schottky-barriers, ohmic contacts, p-n junctions, bipolar transistors, and Si MOS capacitors and field-effect transistors. Basic MOS logic circuits. Selected laboratory work. (.25 ED/.75 ES) One course. *Casey*

**218. Integrated Circuit Engineering.** Basic processing techniques and layout technology for integrated circuits. Photolithography, diffusion, oxidation, ion implantation, and metallization. Design, fabrication, and testing of integrated circuits. (.5 ED/.5 ES) Prerequisite: Electrical Engineering 216. One course. *Casey or Fair*

**219. Digital Integrated Circuits.** Analysis and design of digital integrated circuits. MOSFET and bipolar devices. SPICE models. Major logic families such as NMOS, CMOS, TTL, ECL, and I<sup>2</sup>L as well as regenerative logic circuits and memories. Circuit design considerations for LSI and VLSI. (.5 ED/.5 ES) Prerequisites: Electrical Engineering 157 and 216. One course. *Massoud*

**225. Microwave Electronic Circuits.** Microwave circuit analysis and design techniques. Properties of planar transmission lines for integrated circuits. Matrix and computer-aided methods for analysis and design of circuit components. Analysis and design of input, output, and interstage networks for microwave transistor amplifiers and oscillators. (.5 ED/.5 ES) Prerequisite: Electrical Engineering 161 or equivalent. One course. *Joines*

**234. Power Electronics: High-Power Circuits.** Basic principles of analysis and design of electronic power control and conversion circuits with particular emphasis on thyristor (for example, SCRs, TRIACs) circuits. Characteristics of high-power semiconductors, commutating circuits, AC voltage controllers, AC-to-AC controlled rectifiers, DC-to-DC converters, DC-to-AC inverters, AC-to-AC converters. Laboratory. (.75 ED/.25 ES) Prerequisite: Electrical Engineering 161 or equivalent. One course. *T. G. Wilson*

**235. Nonlinear Magnetic and Semiconductor Power Converters.** Nonlinear magnetic and semiconductor switching characteristics for transient and steady-state analysis of power electronic circuits. Design of saturable and nonsaturating magnetic devices. State-plane analysis of negative-resistance oscillators and self-oscillating inverters. Laboratory. (.75 ED/.25 ES) Prerequisite: Electrical Engineering 161 or equivalent. One course. *T. G. Wilson*

**236. Energy-Storage Power Converters.** Analysis and design of switch-mode electronic power converters utilizing energy-storage principles. Determination of large-signal and small-signal dynamic response and stability of closed-loop regulated converters. Extensive use of computer-aided analysis, design and measurement techniques. Laboratory. (.75 ED/.25 ES) Prerequisite: Electrical Engineering 161 or equivalent. One course. *T. G. Wilson*

**241. Linear Systems.** Modeling of multiple input-output linear systems in the frequency and time domains. Matrix differential and difference equations and their solutions; state variables. Digital simulation of differential systems. Fourier analysis of signals and systems. Transform techniques applied to state variable models. State-space models of distributed systems. (.25 ED/.75 ES) One course. *Kerr or Wang*

**250. Introduction to Robotics.** Fundamental notions in robotics, basic configurations of manipulator arm designs, coordinate transformations, control of robot actions, robot programming, artificial intelligence; machine vision, force, touch, and other sensory systems; selected laboratory assignments. (.25 ED/.75 ES) Prerequisites: Electrical Engineering 112 and consent of instructor. One course. *Wang*

**251. Pattern Classification and Recognition.** Parameter estimation and supervised learning, nonparametric techniques, linear discriminant functions, clustering, language theory related to pattern recognition, examples from areas such as character and severe weather recognition, classification of community health data, recognition of geometrical configurations, algorithms for recognizing low resolution touch-sensor array signatures and 3-D objects. (.5 ED/.5 ES) Prerequisite: consent of instructor. One course. *Wang*

**252. Computer Systems Organization.** See C-L: Computer Science 252. One course. *Patrick or Trivedi*

**253. Digital Control Systems.** Review of traditional techniques used for the design of discrete-time control systems; introduction of "nonclassical" control problems of intelligent machines such as robots. Limitations of the assumptions required by traditional design and analysis tools used in automatic control. (.25 ED/.75 ES) Prerequisite: Electrical Engineering 112. One course. *Myers*

**265. Advanced Topics in Electrical Engineering.** Opportunity for study of advanced subjects related to programs within the electrical engineering department tailored to fit the requirements of a small group. Prerequisites: consent of Director of Undergraduate Studies and of supervising instructor. One course. *Staff*

**271. Electromagnetic Theory.** The classical theory of Maxwell's equations; electrostatics, magnetostatics, boundary value problems including numerical solutions, currents and their interactions, and force and energy relations. Three class sessions. (.25 ED/.75 ES) Prerequisite: consent of instructor. One course. *Hacker or Joines*

**272. Electromagnetic Communication Systems.** Review of fundamental laws of Maxwell, Gauss, Ampere, and Faraday. Elements of waveguide propagation and antenna radiation. Analysis of antenna arrays by images. Determination of gain, loss, and noise temperature parameters for terrestrial and satellite electromagnetic communication systems. (.5 ED/.5 ES) Prerequisite: Electrical Engineering 164 or 271. One course. *Joines*

**273. Optical Communication Systems.** Mathematical methods, physical ideas, and device concepts of optoelectronics. Maxwell's equations, and definitions of energy density and power flow. Transmission and reflection of plane waves at interfaces. Optical resonators, waveguides, fibers, and detectors are also presented. (.25 ED/.75 ES) Prerequisite: Electrical Engineering 143 or equivalent. One course. *Joines*

## **COURSES CURRENTLY UNSCHEDULED**

**185. Pulse and Digital Electronics**

**188. Electrical Energy Systems**

**215. Semiconductor Physics**

**217. Lasers**

**222. Nonlinear Analysis**

**224. Advanced Electronic Circuits**

**226. Modeling and Computer-Aided Analysis of Electronic Systems**

**227. Network Synthesis**

**243. Advanced Linear Systems Theory**

## **THE MAJOR**

The major requirements are included in the minimum total of 34 courses listed under the general requirements and departmental requirements. The electrical engineering department requires the equivalent of 4.25 engineering design and 8.50 engineering science courses.

## **Mechanical Engineering and Materials Science (ME)**

Professor Hochmuth, *Chairman*; Assistant Professor Buzzard, *Director of Undergraduate Studies*; Professors Bejan, Chaddock, Cocks, Dowell, Garg, Gösele, Harman, Pearsall, Shaughnessy, Shepard, and Tan; Associate Professors Bliss, Jones, Quinlan, and Wright; Assistant Professors Cherry, Georgiadis, Knight, and Needham; Research Assistant Professor Tran-Son-Tay; Adjunct Associate Professor Wu; Adjunct Assistant Professors Hart, Jenkins, and Lind

A mechanical engineering major is available in this department.

The profession of mechanical engineering began during the industrial revolution when mankind learned how to use the energy contained in coal and oil to perform useful work. The early mechanical engineers designed the machine tools and the shafts, pulleys, gears, cams, pistons, cylinders, crankshafts, boilers, turbines, and generators for transportation and manufacturing in the eighteenth and nineteenth centuries. These early engineers also discovered a new branch of physics, called thermodynamics, which puts a definite limit on just how much energy can be converted into useful work. Thus, even at its beginning, mechanical engineering involved both science and the art of design.

Modern mechanical engineering contains all of its historical elements plus microprocessors and computers to aid in design and analysis and to create "smart" machines and robots. Also, in a world of expanding population and shrinking natural



resources, modern mechanical engineers must strive to minimize any adverse impacts of their machines and power plants on the environment by minimizing the consumption of energy and the production of pollutants. Finally, they must be able to analyze failures and eliminate them through rational design and selection of materials.

The rapid change of our technological society requires that engineering students learn to think in a fundamental way so they can grow, develop, and adapt throughout life. To accomplish this, students of mechanical engineering first study the "basics": mathematics, including advanced applied mathematics; physics, including classical mechanics, dynamics, and electromagnetics; chemistry; the humanities; and the social sciences. Courses in the mechanical engineering sciences serve as a connecting link between the basic subjects and design. These engineering sciences include thermodynamics, solid and fluid mechanics, heat transfer, and materials science. In order to learn how to acquire and process information and create smart machines, students also take courses in electronics, instrumentation and measurements, and modeling and control of dynamic systems. Finally, students use their knowledge in advanced courses in design. Students may take as electives advanced 200-level courses in thermodynamics, fluid mechanics, lubrication, heat transfer, acoustics, dynamics and control, biochemical engineering, corrosion, electronic materials, polymer science, physical metallurgy, and expert systems. The department has a number of research and teaching laboratories in these areas of study.

**11, 12. Undergraduate Research in Mechanical Engineering.** An elective program in which undergraduate students participate in an ongoing program of research with mechanical engineering faculty members. The research topic pursued by the student is arranged by mutual agreement between the student and the participating faculty member. For freshmen only. Quarter course each. *Staff*

**102. Thermodynamics II.** Application of the laws of thermodynamics to gas and vapor cycles. Compressor, turbine, and internal combustion engine design and performance. Refrigeration systems and analysis and applications in air conditioning. Aircraft propulsion system performance. Thermodynamics of direct energy conversion devices. (.6 ED/.4 ES) Prerequisite: Engineering 101. One course. *Harman*

**113. Introduction to Electronic Materials.** The fundamental relationships between structure and the electronic properties of materials. Emphasis on the interrelationship of solid state chemistry and the control and prediction of concomitant electronic properties. Materials preparation and characterization methods. (.25 ED/.75 ES) Prerequisite: Engineering 83. One course. *Gösele*

**115. Failure Analysis and Prevention.** A study and analysis of the causes of failure in engineering materials and the diagnosis of those causes. Elimination of failures through proper material selection, treatment, and use. Case histories. Examination of fracture surfaces. Laboratory investigations of different failure mechanisms. (.5 ED/.5 ES) Prerequisites: Engineering 75 and 83 or consent of instructor. One course. *Jones, Cocks, or Pearsall*

**120. Engineering Instrumentation and Measurements.** Analysis, design, and application of instrumentation. Error analysis and propagation. Experimental laboratory with PCXT based measurement and data acquisition, analysis, and graphic display. (.25 ED/.75 ES) Corequisite: Engineering 130. One course. *Buzzard*

**126. Fluid Mechanics.** An introductory course emphasizing the application of the principles of conservation of mass, momentum, and energy to a fluid system. Physical properties of fluids, dimensional analysis and similitude, viscous effects and integral boundary layer theory, subsonic and supersonic flows, normal shock waves. Selected laboratory work. (.25 ED/.75 ES) Corequisite: Engineering 101 and 123. One course. *Knight or Shaughnessy*

**141. Mechanical Design.** A study of practical aspects of mechanical design including conceptualization, specifications, and selection of mechanical elements. The design

and application of mechanical components such as gears, cams, bearings, springs, and shafts. Practice in application of the design process through design projects. (1.0 ED) Prerequisite: Mechanical Engineering 115. One course. *Wright*

**150. Heat and Mass Transfer.** A rigorous development of the laws of mass and energy transport as applied to a continuum. Energy transfer by conduction, in laminar and turbulent flow inside and outside of tubes, and by radiation. Application to heat exchangers, thermal power equipment, and heat transfer in the environment. Introduction to the principles of molecular diffusion and convective mass transfer. Use of the analogies between mass, momentum, and energy transfer in problem solving. Selected laboratory work. (.25 ED/.75 ES) Prerequisites: Mechanical Engineering 126 and Mathematics 111. One course. *Chaddock, Georgiadis, or Hochmuth*

**153. Heating, Air Conditioning, and Refrigeration.** Principles of thermodynamics, heat transfer, and fluid flow applied to comfort and industrial air conditioning. Cycles and equipment for heating, cooling, and humidity control. Air transmission and distribution. Modern vapor compression, absorption, and low temperature refrigeration cycles and systems. (.8 ED/.2 ES) Prerequisite: Engineering 101. One course. *Staff*

**160. Mechanical Systems Design.** An integrative design course addressing both creative and practical aspects of the design of systems. Development of the creative design process, including problem formulation and needs analysis, feasibility, legal, economic and human factors, aesthetics, safety, synthesis of alternatives, and design optimization. Application of design methods through several projects including a term design project. (1.0 ED) Prerequisites: Mechanical Engineering 141 and 150. One course. *Staff*

**165, 166. Special Topics in Mechanical Engineering.** Study arranged on a special engineering topic in which the faculty has particular interest and competence as a result of research and professional activities. (.25 ED/.75 ES) Half course or one course each. Prerequisites: consent of instructor and Director of Undergraduate Studies. Variable credit. *Staff*

**183. Power Generation.** Basic concepts of thermodynamics, heat transfer, and fluid flow applied to power generation processes. Nuclear reaction theory and reactor technology; fossil fuel combustion theory and modern boiler practice. Power plant ancillary equipment and processes. Design considerations and analyses include economic and environmental factors. (.6 ED/.4 ES) One course. *Harman*

**198. Projects in Mechanical Engineering.** This course may be assigned by the Chairman of the department to outstanding seniors who express a desire for such work and who have shown aptitude for research in one distinct field of mechanical engineering. (.75 ED/.25 ES) Half course to two courses. Prerequisites: *B* average and senior standing. Variable credit. *Staff*

**202. Engineering Thermodynamics.** Axiomatic formulations of the first and second laws. General thermodynamic relationships and properties of real substances. Energy, availability, and second law analysis of energy conversion processes. Reaction and multiphase equilibrium. Power generation. Low temperature refrigeration and the third law of thermodynamics. Thermodynamic design. (.3 ED/.7 ES) One course. *Bejan*

**205. Biochemical Engineering.** Mathematical analysis of the effects of substrate concentration, pH, temperature, and chemical inhibitors on the rate and yield of biological processes. Enzyme kinetics. Kinetics of cell growth and metabolite production in batch and continuous culture. Design of bioreactors for microbial, mammalian, and plant cell culture. (.25 ED/.75 ES) Prerequisites: calculus and a course in microbial physiology or biochemistry. One course. *Cherry or Quinlan*

- 206. Optimization of Bioprocess Kinetics.** Concepts and mathematical modeling techniques needed to maximize the rates and yields at which cells produce biomass and metabolites. (.25 ED/.75 ES) Prerequisite: Mechanical Engineering 205. One course. *Quinlan*
- 207. Transport Phenomena in Biological Systems.** (.25 ED/.75 ES) See C-L: Biomedical Engineering 207; also C-L: Civil and Environmental Engineering 207. One course. *Bryers, Daniels, or Truskey*
- 208. Introduction to Colloid and Surface Science.** The colloid state: classification of colloids and the theoretical frameworks and experimental techniques involved in their characterization. Interfaces: surface tension and free energy; curved interfaces; adhesion, cohesion and wetting; surface activity; catalytic and mechanical properties of solid surfaces. Inter-Surface Forces: the balance of attractive and repulsive forces which operate between colloidal particles and at macroscopic surfaces. Some emphasis on natural and artificial biomembranes. (1.0 ES) Prerequisite: consent of instructor. One course. *Needham*
- 210. Intermediate Dynamics.** (.25 ED/.75 ES) See C-L: Civil and Environmental Engineering 210. One course. *Dowell*
- 211. Theoretical and Applied Polymer Science.** An advanced course in materials science and engineering dealing specifically with the structure and properties of polymers. Particular attention paid to recent developments in the processing and use of modern plastics and fibers. Product design considered in terms of polymer structures, processing techniques, and properties. (.6 ED/.4 ES) One course. *Pearsall*
- 212. Electronic Materials.** An advanced course in materials science and engineering dealing with the various materials important for solid-state electronics including semiconductors, ceramics, and polymers. Emphasis on thermodynamic concepts and on defects in these materials. Materials preparation and modification methods for technological applications. (.25 ED/.75 ES) Prerequisite: Engineering 83. One course. *Tan*
- 214. Corrosion and Corrosion Control.** Environmental aspects of the design and utilization of modern engineering alloys. Theory and mechanisms of corrosion, particularly in seawater and atmospheric environments. Microstructural aspects of diffusion, oxidation, hot corrosion, and stress corrosion. (.25 ED/.75 ES) Prerequisite: Engineering 83. One course. *Jones*
- 215. Biomedical Materials and Artificial Organs.** See C-L: Biomedical Engineering 215. One course. *Clark*
- 216. Materials Science and Solar Technology.** All aspects of materials science as related to solar energy development. Emphasis is placed on photovoltaic materials and devices, including the relationship of conversion efficiency to material properties and solar cell design. (.5 ED/.5 ES) One course. *Cocks*
- 217. Fracture of Engineering Materials.** Conventional design concepts and their relationship to the occurrence of fracture. Linear elastic and general yield fracture mechanics. Microscopic plastic deformation and crack propagation. The relationship between macroscopic and microscopic aspects of fracture. Time dependent fracture. Fracture of specific materials. (.7 ED/.3 ES) Prerequisites: Engineering 83 and Mechanical Engineering 115. One course. *Jones*
- 218. Thermodynamics of Electronic Materials.** Basic thermodynamic concepts applied to solid state materials with emphasis on technologically relevant electronic materials such as silicon and GaAs. Thermodynamic functions, phase diagrams, solubilities and thermal equilibrium concentrations of point defects; nonequilibrium processes and the kinetic phenomena of diffusion, precipitation, and growth. (.25 ED/.75 ES) One course. *Gösele*



**221. Compressible Fluid Flow.** Basic concepts of the flow of gases from the subsonic to the hypersonic regime. Effects of friction, heat transfer, and shock on one-dimensional inviscid flow. Potential theory, oblique shock waves, and special calculation techniques in two-dimensional flow. (.4 ED/.6 ES) One course. *Shaughnessy*

**224. An Introduction to Turbulence.** Flow instability and the transition to turbulence. Physical characteristics of turbulent flows, averaging, and the Reynolds equation. Turbulent transport and mixing length theories. The statistical description of turbulence, correlations, and spectra. Fourier transforms. Measurement techniques. (1.0 ES) One course. *Shaughnessy*

**225. Mechanics of Viscous Fluids.** Equations of motion for a viscous fluid, general properties and selected solutions of the Navier-Stokes equations, the Stokes equations, laminar boundary layer equations with selected solutions and approximate techniques, origin of turbulence. (1.0 ES) One course. *Hochmuth*

**226. Intermediate Fluid Mechanics.** A survey of the principals, concepts, and equations of fluid mechanics. Fluid statics. Surface tension. The Eulerian and Lagrangian description. Kinematics. Reynolds transport theorem. The differential and integral equations of motion. Constitutive equations for a Newtonian fluid. The Navier-Stokes equations. Boundary conditions on velocity and stress at material interfaces. (.2 ED/.8 ES) One course. *Shaughnessy*

**227. Advanced Fluid Mechanics.** Flow of a uniform incompressible viscous fluid. Exact solutions to the Navier-Stokes equation. Similarity methods. Irrotational flow theory and its applications. Elements of boundary layer theory. (.2 ED/.8 ES) Prerequisite: Mechanical Engineering 226 or consent of instructor. One course. *Shaughnessy*

**228. Lubrication.** Derivation and application of the basic governing equations for lubrication; the Reynolds equation and energy equation for thin films. Analytical and computational solutions to the governing equations. Analysis and design of hydrostatic and hydrodynamic slider bearings and journal bearings. Introduction to the effects of fluid inertia and compressibility. Dynamic characteristics of a fluid film and effects of bearing design on dynamics of machinery. (.25 ED/.75 ES) Prerequisites: Mathematics 111 and Mechanical Engineering 126. One course. *Knight*

**229. Computational Fluid Mechanics and Heat Transfer.** An exposition of numerical techniques commonly used for the solution of partial differential equations encountered in engineering physics. Finite-difference schemes (which are well-suited for fluid mechanics problems); notions of accuracy, conservation, consistency, stability, and convergence. Recent applications of weighted residuals methods (Galerkin), finite-element methods, and grid generation techniques. Through specific examples, the student is guided to construct and assess the performance of the numerical scheme selected for the particular type of transport equation (parabolic, elliptic, or hyperbolic). (.5 ED/.5 ES) One course. *Georgiadis*

**230. Modern Control and Dynamic Systems.** Dynamic modeling of complex linear and nonlinear physical systems involving the storage and transfer of matter and energy. Unified treatment of active and passive mechanical, electrical, and fluid systems. State-space formulation of physical systems. Time and frequency-domain representation. Controllability and observability concepts. System response using analytical and computational techniques. Lyapunov method for system stability. Modification of system characteristics using feedback control and compensation. Emphasis on application of techniques to physical systems. (.25 ED/.75 ES) One course. *Garg*

**236. Engineering Acoustics.** Fundamentals of acoustics including sound generation, propagation, reflection, absorption, and scattering. Emphasis on basic principles and analytical methods in the description of wave motion and the characterization of sound fields.

Applications including topics from noise control, sound reproduction, architectural acoustics, and aerodynamic noise. Occasional classroom or laboratory demonstration. (.25 ED/.75 ES) Prerequisites: Mathematics 111 and Engineering 123 or consent of instructor. One course. *Bliss*

**237. Aerodynamics.** Fundamentals of aerodynamics applied to wings and bodies in subsonic and supersonic flow. Basic principles of fluid mechanics and analytical methods for aerodynamic analysis. Two- and three-dimensional wing theory, slender-body theory, lifting surface methods, vortex and wave drag. Brief introduction to vehicle design, performance, and dynamics. Special topics such as unsteady aerodynamics, vortex wake behavior, and propeller and rotor aerodynamics. (.25 ED/.75 ES) One course. *Bliss*

**240. Patent Technology and Law for Engineers.** The use of patents as a technological data base is emphasized including information retrieval in selected engineering disciplines. Fundamentals of patent law and patent office procedures. (.6 ED/.4 ES) One course. *Cocks*

**245. Applications in Expert Systems.** A comprehensive introduction to the key practical principles, techniques, and tools being used to implement knowledge-based systems. The classic MYCIN system studied in detail to provide historic perspective. Current systems employing combinations of production rules, prototypical knowledge, and frame-based case studies. Student term projects consist of the development of individual, unique expert systems using the Texas Instruments Personal Consultant. Knowledge of LISP not a prerequisite. (.5 ED/.5 ES) One course. *Wright*

**265. Advanced Topics in Mechanical Engineering.** Opportunity for study of advanced subjects related to programs within mechanical engineering tailored to fit the requirements of a small group. (.25 ED/.75 ES) Prerequisite: approval of Director of Undergraduate or Graduate Studies. One course. *Staff*

**270. Robot Control and Automation.** Review of kinematics and dynamics of robotic devices; mechanical considerations in design of automated systems and processes, hydraulic and pneumatic control of components and circuits; stability analysis of robots involving nonlinearities; robotic sensors and interfacing; flexible manufacturing; man-machine interaction and safety consideration. (.5 ED/.5 ES) Prerequisites: Mechanical Engineering 230 or equivalent and consent of instructor. One course. *Garg*

**277. Optimization Methods for Mechanical Design.** Definition of optimal design. Methodology of constructing quantitative mathematical models. Nonlinear programming methods for finding "best" combination of design variables: minimizing steps, gradient methods, flexible tolerance techniques for unconstrained and constrained problems. Emphasis on computer applications and term projects. (.5 ED/.5 ES) Prerequisite: consent of instructor. One course. *Wright*

**280. Convective Heat Transfer.** Models and equations for fluid motion, the general energy equation, and transport properties. Exact, approximate, and boundary layer solutions for laminar flow heat transfer problems. Use of the principle of similarity and analogy in the solution of turbulent flow heat transfer. Two-phase flow, nucleation, boiling, and condensation heat and mass transfer. (1.0 ES) One course. *Bejan*

**281. Conduction and Radiation.** Conduction heat transfer in the steady and transient state, in rectangular, cylindrical, and spherical coordinates. Melting and solidification. Radiation exchange involving absorbing and emitting media including gases and flames, combined conduction and radiation, and combined convection and radiation. Exact and approximate methods of solution including separation of variables, transform calculus, numerical procedures, and integral and variational methods. (1.0 ES) One course. *Bejan*

## **COURSES CURRENTLY UNSCHEDULED**

### **235. Advanced Mechanical Vibrations**

#### **THE MAJOR**

The major requirements are included in the minimum total of thirty-four courses listed under the general requirements and departmental requirements. Specific courses which must be included are Engineering 75, 83, 101, 123, and 130; Mechanical Engineering 115, 120, 126, 141, 150, and 160.





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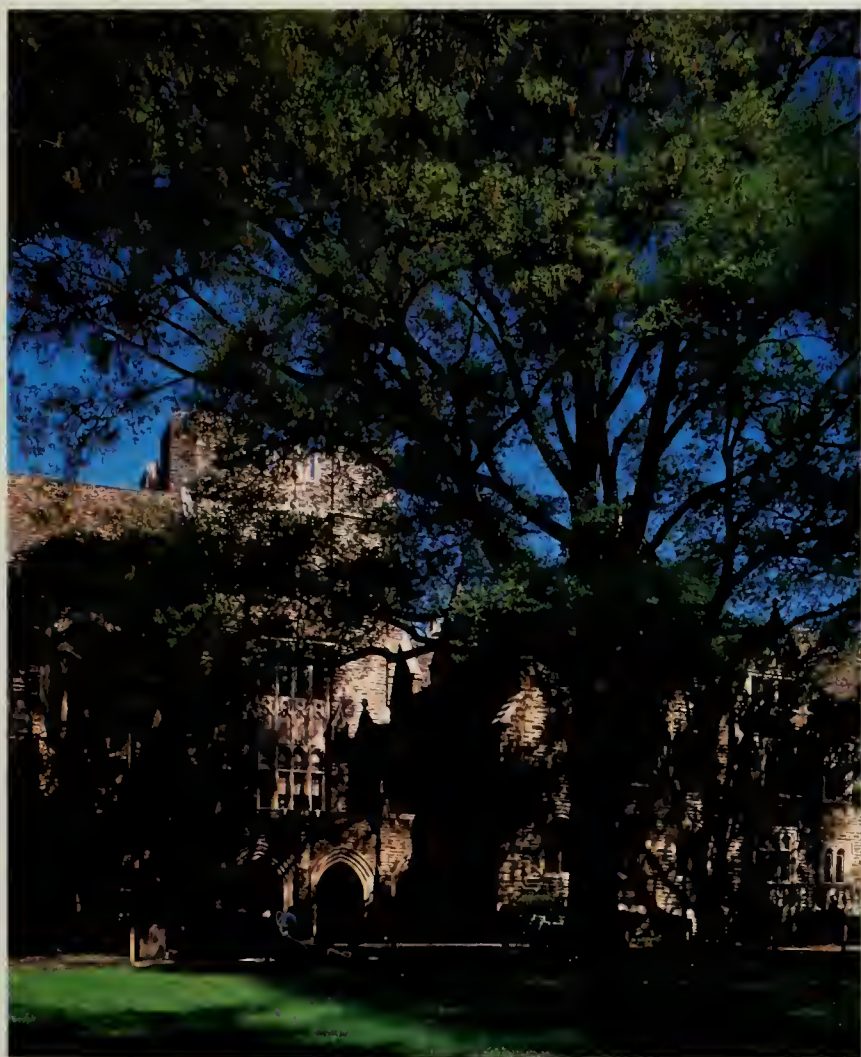
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The information in the bulletin applies to the academic year 1989-90 and is accurate and current, to the best of our knowledge, as of April, 1989. The university reserves the right to change programs of study, academic requirements, lecturers, teaching staffs, the announced University calendar, and other matters described in the bulletin without prior notice, in accordance with established procedures.

The Bulletin of Duke University, Volume 61, includes the following titles: *The Fuqua School of Business; The School of Forestry and Environmental Studies; Marine Laboratory; Undergraduate Instruction; The Graduate School; The Medical Center; The Divinity School; Information for Prospective Students; The Graduate School (short form); Allied Health Programs; The School of Law; and Information and Regulations.*

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## To the Prospective Graduate Student

A graduate school is where excellence is established in a university. At Duke, the Graduate School is where the two essential functions of a university, teaching and research, truly come together. Over the years Duke's strength at the graduate level has grown in all the main fields of knowledge. The nineteen-eighties have been particularly fruitful years for recruitment of faculty, establishment of new programs, and attraction of outstanding students. The faculty enjoys international distinction. The laboratories, libraries, and computer facilities are among the very best. Yet the Graduate School remains small enough so that personal contact is a central feature of our programs, and fruitful interaction across disciplines is a common experience, both for faculty and students.

For the student in search of a strong graduate education, Duke University has much to offer. This is a community in which minds and ideas grow. We provide training for many careers, but we also seek to foster personal creativity and to provide stimulating yet congenial surroundings for productive education and research.

The following pages provide the information you require in making the important choice of the course of your graduate education. We look forward to welcoming you to the Duke community of scholars.

A handwritten signature in black ink that reads "Malcolm Gillis". The signature is written in a cursive style with a large, prominent 'M' and 'G'.

Malcolm Gillis  
*Dean of the Graduate School*

# University Administration

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# Introduction

## A Community of Scholars

Writing in the 1920s the philosopher and man of science, Alfred North Whitehead, defined the purpose of a university in these terms: "The justification of a university is that it preserves the connection between knowledge and the zest for life by uniting the young and the old in the imaginative consideration of learning." If this is true of a university generally, it is true of a graduate school especially. Faculty members and graduate students work together in the imaginative recasting of ideas necessary for successful research and the development of human knowledge.

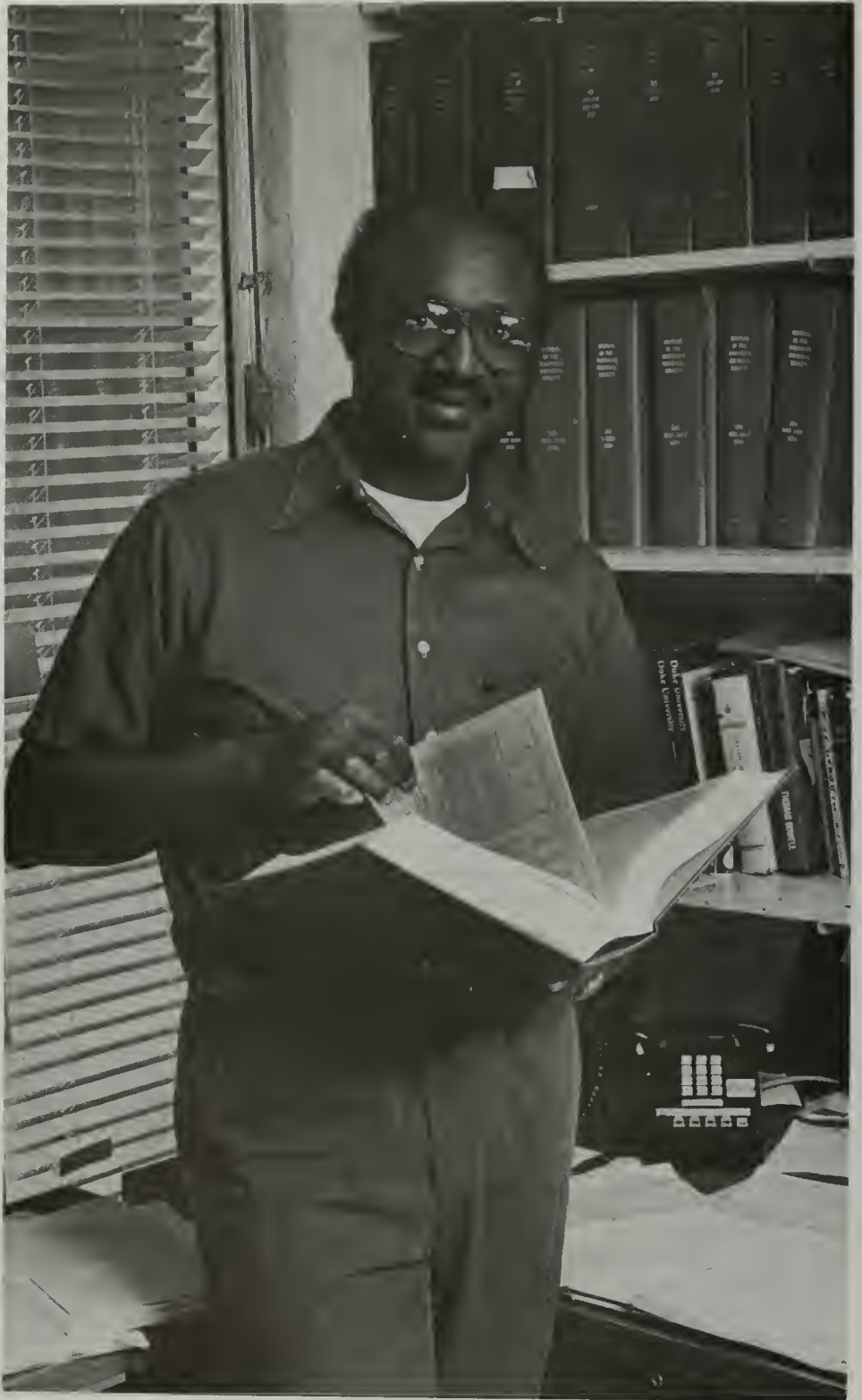
Ideally, a graduate school is a community of scholars engaged in imparting and extending the realm of human knowledge in the arts and sciences. A select group of students is admitted each year to undergo the rigorous discipline of an advanced degree program, the successful among them to emerge as scholars of promise. To enter into graduate education today is to accept a real challenge, and this decision should not be made casually. The work toward a doctorate requires several years of tireless effort and possibly sacrifice, and the material rewards may be less certain than in some alternative endeavor. However, pursued with determination, graduate education can be the doorway to a stimulating, creative, and meaningful life. The student who is contemplating this challenge may have many questions in mind; the material that follows is an attempt to answer some of them.

## The Decision to Go to Graduate School

The decision to work toward an advanced degree must be a personal commitment born of a willingness to devote oneself to many months or possibly years of academic discipline just at an age when one may be impatient for financial independence and freedom from academic discipline. Graduate study requires all of one's energy and enthusiasm; to enter into it half-heartedly is to invite discouragement or failure.

Qualities instrumental for success in graduate study are a natural curiosity and the capacity for self-discipline. A good undergraduate record may or may not be adequate evidence of these characteristics. Many students with excellent undergraduate records have been unsuccessful in graduate study because their undergraduate training stressed the marshalling and articulation of facts rather than real understanding and analysis of material. On the other hand, many distinguished scholars had undistinguished undergraduate records. In gaining admission to a graduate school, the undergraduate record





is, of course, an important element, but usually some margin is left to allow for students who develop serious academic interests late in their undergraduate careers. Students are often best able to judge for themselves whether their grades truly gauge their abilities.

There is no unerring way of knowing in advance whether one will be successful or happy in graduate school. It is quite likely, however, that if one has both motivation and ability and does not try it, there will be regrets in later years. Although the decision must be an individual choice, superior intellectual ability is a scarce human resource, and the encouragement and utilization of it is a matter of community as well as personal concern.

## Choosing a Graduate School

Over 250 universities today offer work leading to the Ph.D. degree. Among these are about 60 institutions which grant only two or three such degrees a year in all fields combined. At the other end of the scale are about 50 universities which account for nearly 70 percent of all doctorates granted in this country. Duke University is among the latter, as are most of the major institutions which offer programs in a wide range of academic disciplines. But even if one can narrow the field to about 50 major institutions, how does one select among these, and what factors should affect one's final choice? A few key factors are discussed briefly below.

**Size.** Size is not an infallible guide to the quality of a graduate school. There are a number of poor graduate schools of exceedingly large size and a number of extremely good small ones. However, the ideal is a small number of superior students working closely in intellectual pursuits with a few esteemed scholars. It might be helpful simply to mention a few of the disadvantages of too many or too few students.

In an extremely large graduate school—there are some that have between 6,000 and 12,000 enrolled—classes of 50 to 100 students, inaccessibility of senior faculty, shortage of library materials and facilities, and only a nodding acquaintance with fellow students are a few of the possible drawbacks. An able student may develop well even in this atmosphere of mass production, but it is hardly the ideal.

An extremely small graduate school also has its disadvantages. Facilities are often limited, and the faculty is likely to be composed primarily of undergraduate instructors. A university must be willing to commit a significant portion of its resources to develop a graduate program of high quality, and this is often not the case in an extremely small graduate school.

More important than the size of the entire graduate school is the size of the particular departmental program in which a student is interested. An optimum doctoral program will have an enrollment of perhaps 25 to 100 students, admitting 10 to 30 new students each year and awarding perhaps three to ten Ph.D. degrees a year. This information is usually available in university catalogs or government publications on higher education.

Duke University is committed to programs of moderate size in which the interests of the student are important. Total enrollment in the Graduate School is 1,998 students. Between 500 and 550 new students are admitted each year from approximately 4,200 applications. Only eight departments have more than 80 students; thirty departments have enrollments that fall within the optimum range suggested in the preceding paragraph.

**Quality.** Not only do universities differ considerably in their reputation for quality, but there are marked differences among departments within any university. Many excellent universities have a few weak departments in which a student would fare less well than in an excellent department in a less esteemed institution. Therefore, the student should not be guided solely by the reputation of a university as a whole, but should inquire more specifically about the area of specialization.

Since judging the quality of a graduate program is necessarily subjective, no two people are likely to be in complete agreement. Prospective students would do well to talk with their undergraduate professors, particularly those who have themselves achieved some

reputation in the world of scholarship. As witnessed by their own continuing writing and research, they are more likely to have reliable information on the merits of various graduate programs. Similarly, younger faculty members who are only four or five years out of graduate school may have more recent acquaintance with their own and other schools.

Another guide may be occasional questionnaires asking educators to rank various graduate departments.

Alone, none of these guides is adequate; however, in conjunction with individual advice and recommendations, they can serve as useful indicators. In summary, the best procedure is to take as many factors as possible into account, and then to apply to three or four of the schools high in consideration. (Applying to fifteen universities is a waste of the applicant's and the universities' time.) Write to the graduate school or to the departmental Director of Graduate Studies if further information is desired; visit the university in person, if possible; and carefully weigh the advice of distinguished faculty members of one's undergraduate college.





## Duration of Program

The length of time a graduate student spends in study toward an advanced degree depends upon the requirements of the individual program, on personal work habits, and on the environment of the graduate school and the department in which the study is conducted.

The student's level of preparation before entering graduate school has a direct bearing on the speed with which the degree may be earned. A student who enters with proficiency in one or more foreign languages and a good foundation in the chosen field may well be able to finish within the minimum time limits. On the other hand, the student who is not as well prepared may find that one and a half to two years are the minimum for the A.M. degree, and four to five years for the Ph.D. degree (although wise use of the summers may reduce this time somewhat). The total time may also be lengthened if the student must work during part of the period of residence.

The attitude of the graduate school and its various departments will also affect the time needed to complete the degree. During the last decade the average time elapsing between entering graduate school and receiving the doctorate in American universities has been about ten years. At Duke the average doctorate in the humanities requires a little over seven years, nearly six years in the social sciences, and slightly over four years in the sciences. Over the last few years, Duke University has been among the forerunners in reducing even further the time needed to obtain the Ph.D. without any sacrifice in quality. This effort has taken the form of trying to eliminate unnecessary delays, particularly those due to financial burdens on the student. Duke ranks among the leading institutions in the country today in terms of financial aid per student from university sources. Moreover, much of this aid is in the form of fellowships and scholarships which do not require burdensome services in return. The large public institutions are often more restricted to awards which require substantial teaching, research, or other duties, thus reducing the speed with which a student can complete the resident course work. A student will be wise to inquire to what extent progress toward a degree may be delayed by the work entailed in certain awards. If, for example, an assistantship lengthens unduly the time necessary to obtain a degree, a smaller fellowship may be preferable. The duration of the graduate program depends on several factors, but the policy of the Duke Graduate School is to keep the length of time a student is involved in obtaining an advanced degree at a minimum.



# Duke University Graduate School

## Teaching and Research

In surveying the progress made in the first seven years after the founding of Duke University, its first President, William Preston Few, wrote that he wanted "to see the Graduate School made strong because it will best and most quickly ensure our attaining and maintaining a place of real leadership in the educational world." President Few believed that "more than anything else here our Graduate School will determine the sort of University we are to build and its standing in the educational world." This conviction has continued to prevail to the present day, with emphasis upon the interdependence of teaching and research as the necessary components of scholarship.

Over 700 members of the graduate faculty teach the approximately 900 courses and seminars offered in the Graduate School and supervise thesis and dissertation research. Many of the major universities of the world have helped to train this faculty; approximately 90 percent of the graduate staff hold degrees from the 52 institutions which make up the Association of Graduate Schools within the Association of American Universities. By place of birth, the faculty represent almost every state in the nation and almost two dozen foreign countries.

The groundwork for learning may be laid in privacy—indeed a certain amount of private study and research is absolutely essential—but the vital stimulus to the learning process comes from one's contact with the minds of other people with similar or related interests. This is precisely why graduate schools are highly selective in their admissions policies, and it is one of the important reasons for their willingness to offer attractive fellowship awards to outstanding students. The superior student is a valuable catalyst both for fellow students and for faculty and is prized as such.

Faculty and students comprise the essential human factor in education, but their joint endeavor cannot prosper without adequate research and library facilities. Duke University has research facilities for physics, botany, zoology, chemistry, psychology, sociology, engineering, and biochemistry, as well as well-equipped laboratories in the various departments of medical science. They have been built entirely, or modernized and expanded, within recent years. The University has an excellent Computation Center on the campus and shares a computing facility with the University of North Carolina and North Carolina State University. The Triangle Universities Computation Center is among the largest research-oriented computer facilities in the world. The University has an excellent research library. In number of volumes, serials, and documents, and in breadth of coverage, the



library offers more resources than many graduate schools with enrollments two or three times Duke's size. To the student in the arts, humanities, or social sciences, this is an immeasurable asset.

Among the many special features of the Graduate School a few important examples may be mentioned. For students in the biological and physical sciences, the facilities of the Duke Marine Laboratory at Beaufort, North Carolina, are available for course work and research. The laboratory has research buildings, classrooms, research vessels, and living quarters which make it an excellent research center in marine biology. Closer to home are the 8,300 acres of Duke Forest, managed by the School of Forestry and Environmental Studies, ideal for research on timber growth, soils, and related topics. A regional nuclear structure laboratory is housed on the campus and serves the major universities in the area. The phytotron, adjacent to the botany greenhouses, is an integrated series of plant-growth rooms, chambers, and greenhouses, with forty-six separately controlled environments providing more than 4,000 square feet of plant-growing space. The environmental factors controlled in the units for the study of plant growth include light, temperature, nutrients, carbon dioxide concentration, and humidity.

Additional resources and facilities are available to the graduate student through Duke's fine Schools of Law, Business, Medicine, Engineering, Forestry and Environmental Studies, and the Divinity School. A two-term summer session and the availability of courses at the nearby University of North Carolina at Chapel Hill, North Carolina Central University in Durham, and North Carolina State University in Raleigh, under a cooperative arrangement, offer other opportunities to the graduate student.

No description of programs can begin to give the prospective student the full flavor of graduate study in a particular institution. If practical, a visit to the universities in which one is interested is always helpful. The Duke Graduate School offers a warm invitation to prospective students to come to the campus during the year to discuss their possible application and admission.

The visitor will find at Duke most of the facilities that one could hope for in the largest of institutions, and yet the University has been fortunate in avoiding many of the evils that seem inevitable with mass education. Despite a total University enrollment of approximately 9,500, Duke has retained the sense of community that one usually associates with a small liberal arts college. And in an age when current architectural whim often adds yet another stylistic variant to an already eclectic array of buildings, Duke has built a campus of unusual and architecturally coherent beauty. This, too, is an important part of education, creating an environment conducive to learning.

## Special Programs

**Center for the Study of Aging and Human Development.** The primary aims of the center are to encourage and support basic and applied research on biomedical, behavioral, and social scientific aspects of adult development and aging; to train investigators for such research; to provide clinical training in geriatrics for health professionals; and to develop sources of scientific information which are accessible to interested individuals, organizations, and governmental agencies. Although the center does not offer degrees, the varied programs, research laboratories, and clinical settings provide a context and resource for undergraduate and graduate students and for health professionals with a special interest in adult development and aging. Inquiries should be addressed to Harvey Jay Cohen, M.D., Director, Duke University Center for the Study of Aging and Human Development, Box 3003, Duke University Medical Center, Durham, North Carolina 27710.

**Asian-Pacific Studies Institute.** The institute sponsors an agenda of visiting speakers and scholars and coordinates study abroad programs in China and Japan. A limited number of fellowships are granted which provide stipends for a two-year period. Incoming graduate students with the Ph.D. as their objective, students in good standing in the first year of study in Duke professional schools, and current Duke students enrolled in

Ph.D. programs may be considered for these fellowships. Further information may be obtained from The Asian-Pacific Studies Institute, 2111 Campus Drive, Duke University, Durham, North Carolina 27706.

**The Center for Biochemical Engineering.** The Center for Biochemical Engineering offers versatile and broad education at the graduate level for students interested in developing and using engineering principles to understand and implement biological and biochemical processes. The programs of study in biochemical engineering are thus interdisciplinary. Students follow a program of course work to reinforce advanced principles of chemical process engineering, mathematics, and physics, as well as microbiology, biochemistry, immunology, and genetics. Close relations are maintained with many departments and schools of the University, and research projects involving work in these other departments are encouraged. Major emphasis is placed on study leading to the Ph.D., the traditional degree of scholarship awarded for mastery of a significant field of knowledge. This mastery is demonstrated by a combination of course work in a major and minor field, completion of an original research project submitted as a dissertation, and a successful defense of the research. Programs leading to the Master of Science degree are also available. Students from non-engineering programs are encouraged to apply to either degree program. Further information may be obtained from the Director of Graduate Studies, The Center for Biochemical Engineering, Teer Engineering Building, Duke University, Durham, North Carolina 27706.

**Canadian Studies Program.** The purpose of the program is to increase American knowledge and understanding of Canada by formalizing and expanding graduate interest in Canada, introducing the study of Canadian life and culture at the undergraduate level, and encouraging such study in primary and secondary schools. The program awards a limited number of graduate fellowships and teaching assistantships to resident or incoming graduate students who undertake a dissertation topic on Canada or Canadian-American relations; sponsors lectures by Canadian specialists; and supports seminars devoted to Canada. Inquiries should be addressed to the Director, Canadian Studies Center, 2016 Campus Drive, Duke University, Durham, North Carolina 27706.

**The University Program in Cell and Molecular Biology.** This program centralizes the cell, developmental, and molecular biology research training found in eight of the University's departments: biochemistry, botany, cell biology/physiology, microbiology and immunology, neurobiology, pathology, pharmacology, and zoology. Prospective students may either apply to one of the participating departments, or apply directly to the program. Applications for admission and fellowship support must be received by February 1, but early applications may receive advance consideration. Inquiries should be addressed to Dr. Bernard Kaufman, The University Program in Cell and Molecular Biology, Box 3711, Duke University Medical Center, Durham, North Carolina 27710.

**Continuing Education.** Local adult residents may pursue graduate academic study at Duke as nondegree students through the Office of Continuing Education, which will provide both academic and career counseling to such students. Up to 12 graduate credits earned by a nondegree Continuing Education student in graduate courses taken at Duke before full admission to the Graduate School may be carried over into a graduate degree program if (1) the action is recommended by the student's Director of Graduate Studies, (2) the work is not more than two years old, and (3) the work is of G level or better. GRE workshops are also offered regularly. Information and applications may be obtained from the Office of Continuing Education, The Bishop's House, Duke University, Durham, North Carolina 27708.

**Cooperative Programs with Neighboring Universities: Library Exchange.** Through a cooperative lending program, graduate students of the University of North Carolina and Duke University are granted library loan privileges in both universities.

**Cooperative Program in Russian and East European Studies.** The graduate schools of Duke University and the University of North Carolina offer a cooperative program leading to the A.M. and Ph.D. degrees in several disciplines (economics, history, literature, linguistics, political science, and psychology), with a concentration in Russian and East European studies. Students admitted to one institution are encouraged to enroll in courses advantageous to their programs at the other institution, to utilize the libraries and facilities of both universities, and to participate in the periodic colloquia involving the personnel of the two institutions and distinguished visiting scholars. For information, contact Professor Martin Miller, Department of History, Duke University, Durham, North Carolina 27708.

**Center for Demographic Studies.** The facilities of the center, located at 2117 Campus Drive, include a population library, the Joseph J. Spengler Collection of publications and research materials, and extensive data resources. These are available to the entire Duke community. The center does not offer degrees; it promotes the pursuit of advanced degrees, with a specialization in population studies, through either the Department of Sociology or the Department of Economics. The center's program provides opportunities for direct student participation in ongoing research projects. The program of extramural research stresses, but is not limited to, work in the demography of aging, health, mortality, fertility, and migration. Inquiries for training and research opportunities may be directed to Dr. George C. Myers, Director, Center for Demographic Studies, 2117 Campus Drive, Durham, North Carolina 27706.

**The Program for the Study of Developed Shorelines.** The Program for the Study of Developed Shorelines was established in recognition of a critical need for both academic programs and geological research on national coastal issues. The goal of the program is promotion of research, education, and publications concerned with oceanic shorelines already under development. A limited number of graduate research fellowships are available to both M.S. and Ph.D. candidates and postdoctoral support is available for individuals involved in appropriate research. The program is centered entirely within the Department of Geology and fellows supported by the program must satisfy all departmental requirements. For more information contact Professor Orrin Pilkey, Director, Program for the Study of Developed Shorelines, Department of Geology, Duke University, Durham, North Carolina 27709.

**The University Program in Genetics.** This is an interdisciplinary program with a faculty drawn from several of the biological science departments (biochemistry, botany, cell biology, microbiology and immunology, zoology), and is designed to meet the needs of students with a variety of educational backgrounds and professional objectives who are interested in specializing in the field of genetics. Interested students should apply for admission to the department of their choice, and after being admitted make arrangements to participate in the program. For information, consult Dr. P. Modrich, Director, The University Program in Genetics, Department of Biochemistry, Box 3711 Duke University Medical Center, Durham, North Carolina 27710.

**Master of Arts Program in Humanities.** This interdepartmental program centered in the humanities and leading to the A.M. degree is designed for students whose interests cross disciplinary lines and are not easily met by departmental programs. Students select a set of thematically related courses from the graduate level offerings of humanities departments, and, where appropriate, from other departments as well. The interdepartmental committee which manages the program offers aid in tailoring a set of courses to the individual student's needs, approves the program chosen, and provides ongoing supervision. Information on program requirements and admission may be found in the chapter on "Advanced Degree Programs." Additional information may be obtained by writing the Director of Graduate Studies, Master of Arts Program in Humanities, The Graduate School, 127 Allen Building, Duke University, Durham, North Carolina 27706.



**Program in International Development Policy.** The Duke Center for International Development Research provides long and short-term training for mid-career professionals from developing and industrialized countries. The Program in International Development Policy (PIDP) is a year-long program in policy design and implementation with a master's degree option.

The structural core of the PIDP consists of two simultaneous year-long development policy seminars attended by all participants. During the 1989-90 academic year, one seminar focuses on export-oriented natural resource exploitation for development, and the other seminar explores the evolution of the public sector.

Beyond the development policy seminars, PIDP fellows have the opportunity to draw from the extensive resources of the Institute of Policy Sciences and Public Affairs and of Duke University—particularly the graduate and professional schools. Fellows are able to map out a course of study which addresses their specific needs—whether that need is to supplement training through course work across a range of fields, to focus on an integrated curriculum leading to a master's degree, or to concentrate completely on the research generated through the development policy seminars.

**Duke University International House.** International House is the center of cocurricular programs for the more than four hundred students from sixty-nine countries who are presently enrolled at Duke. Programs which assist students from abroad in participating in the life of the Durham and Duke communities include: an intensive orientation program at the beginning of the academic year; the International Friends Program (formerly Host Family Program), in which interested international students may become acquainted with American families; the Duke Partners Program which pairs an American and visiting partner for weekly meetings to practice English and to learn about each other's cultures; the International Wives Club, which provides a structure for international women to meet with American women in an informal atmosphere; the Speakers' Bureau, which arranges for international students to speak at civic and social groups as well as schools in the Durham community; intermediate level English conversation and grammar classes which meet twice a week; and the Friday coffee break in the basement of the Chapel which is sponsored by Campus Ministry especially for internationals and friends. The International Association is a student organization which includes a significant number of American members, as well as international students. The association plans social and cultural programs which emphasize personal contact and the informal exchange of ideas among students from diverse backgrounds. Included are weekly open-houses with lectures, films, pot-luck dinners, or parties; periodic trips outside of Durham; and an annual International Day on campus which draws visitors from throughout the area. Additional information may be obtained by writing to Carlisle C. Harvard, Director, International House, 2022 Campus Drive, Duke University, Durham, North Carolina 27706.

**Islamic and Arabian Development Studies.** This program, begun in 1977 with the assistance of grants from the government of Saudi Arabia and some twenty corporations in the United States, sponsors conferences and research on Islamic themes with special reference to developmental problems of the Arabian peninsula. The program has supported courses and seminars on the language, art, and contemporary problems of the Islamic world. It sponsored student delegations to the annual Model Assembly of the League of Arab States in Washington, D.C. The 1984 delegation won the highest number of awards given to any participating university. Twelve faculty members from outreach colleges were awarded fellowships for study in Cairo and six Duke faculty were given fellowships for study in Jordan in 1984. The program was the recipient of a bequest by the late Joseph J. Malone of his library in Arabian affairs. The program also arranged for acquisition by Perkins Library of the Louis and Nancy Hatch Dupree Collection on Islamic Central Asia. The program has sponsored four international conferences, two at Duke, one at Kiawah Island and the fourth at the Rockefeller Foundation Conference Center, Bellagio, Italy. The program also sponsors an outreach program which includes

Appalachian State University, Belmont Abbey College, the College of Charleston, Converse College, Davidson College, Johnson C. Smith University, Old Dominion University, and the University of the South. Inquiries should be addressed to Dr. Ralph Braibanti, Director, Islamic and Arabian Development Studies, 2114 Campus Drive, Duke University, Durham, North Carolina 27706.

**Latin American Studies Program.** The Graduate School offers an interdepartmental program in Latin American studies in conjunction with several departments. Students apply to the Departments of Cultural Anthropology, Economics, History, Political Science, Sociology, or Romance Studies, fulfilling the requirements of those departments and writing their A.M. and Ph.D. degrees under their auspices. In consultation with the candidate, a faculty committee will determine a special program of study giving the candidate rigorous training in the Latin American field in addition to their disciplinary training. The holdings of the Perkins Library for graduate work and research in Latin-American history, inter-American relations, economic history, politics, art, and Spanish-American literature are constantly being enlarged. Program faculty are involved in different national research programs dealing with Latin American topics and offer advice on fellowship support for graduate research in Latin America and the Caribbean. Inquiries should be directed to the Council on Latin American Studies, Center for International Studies, 2122 Campus Drive, Duke University, Durham, North Carolina 27706.

**Master of Arts in Liberal Studies.** The Master of Arts in Liberal Studies is an interdisciplinary program that allows individuals with a variety of professional and personal educational goals the flexibility to pursue their interests across traditional disciplinary boundaries. The program is managed by an interdepartmental committee. Students study primarily on a part-time basis and choose from an array of interdisciplinary courses developed specifically for this program. In addition, the students may select other graduate-level courses that fit their individual needs and interests. For further information, call or write the Director, Master of Arts in Liberal Studies Program, Room 120 Allen Building, Duke University, Durham, North Carolina 27706, (919) 684-3222.

**The Graduate Program in Literature.** The doctoral Program in Literature at Duke has as its goals the education of men and women who will be fully qualified to teach in departments of national literatures as well as in humanities and other interdisciplinary programs. The program is not comparatist in the traditional sense but theoretical in focus, dedicated to the understanding of cultural history and the reshaping of literary studies in the context of contemporary thought. All the literature departments cooperate in this program and its students have access to all courses given under the auspices of the graduate faculties in the humanities. A full descriptive brochure is available. To obtain the brochure or other information, contact Dr. Annabel Patterson, Director of Graduate Studies, Graduate Program in Literature, 305 Carr Building, Duke University, Durham, North Carolina 27706.

**Medical Historian Training Program.** Conducted under the auspices of the School of Medicine and the Graduate School, this program requires a minimum of six years of graduate study for the M.D.-Ph.D., and four or five years for the M.D.-A.M. The M.D.-Ph.D. program is intended for those students who know that their major career effort will be in teaching and other scholarly activities in the history of medicine (not necessarily to the total exclusion of clinical medicine). The M.D.-A.M., on the other hand, is appropriate for those who are undecided, but who wish to acquire a firm foundation for future study, or for those who are seriously interested in pursuing an avocation in the history of medicine. Applicants must meet the requirements for admission to the School of Medicine and the Graduate School in the Department of History. Inquiries should be addressed to Dr. Peter English, Director, Medical Historian Training Program, Box 3420, Duke University Medical Center, Durham, North Carolina 27710.

**Medical Scientist Training Program.** This program is conducted under the auspices of the Graduate School and the School of Medicine and is designed for students with a

strong background in science who are motivated toward a career in the medical sciences and academic medicine. It provides an opportunity to integrate graduate education in one of the sciences basic to medicine with the clinical curriculum of the School of Medicine, and usually requires six to seven years of study leading to both the M.D. and Ph.D. degrees. Interested students should apply for admission to both the Graduate School and the School of Medicine. Additional information may be obtained by consulting Dr. Salvatore Pizzo, Director, Medical Scientist Training Program, Department of Pathology, Box 3712, Duke University Medical Center, Durham, North Carolina 27710.

**Program in Medieval and Renaissance Studies.** This program is administered by the Duke University Center for Medieval and Renaissance Studies. A participating student is enrolled in one of the regular departments and fulfills the Ph.D. requirements for that discipline while taking a program of electives which will advance his or her interdisciplinary competence in the medieval or Renaissance areas. Such a program may include a choice from the fields of art history, language and literature, history, philosophy, and religion. Participation in the program will fulfill the Graduate School requirement for work in a related field. Inquiries should be addressed to the Director of Graduate Studies, Duke University Center for Medieval and Renaissance Studies, Box 4666, Duke Station, Durham, North Carolina 27706.

**Oak Ridge Associated Universities.** Duke University is one of the sponsoring universities of the Oak Ridge Associated Universities located at Oak Ridge, Tennessee. The graduate research program at Duke has available to it all of the facilities of the Oak Ridge National Laboratory and the cooperative supervision of student research by the staff at Oak Ridge. Fellowships in several fields of science are available to qualified applicants. Further information may be obtained from Judith Argon, Office of Research Support, 001E Allen Building, Duke University, Durham, North Carolina 27706.

**Institute of Policy Sciences and Public Affairs.** See Public Policy Studies in the chapter on "Advanced Degree Programs" in this bulletin.

**Center for Resource and Environmental Policy Research.** Housed in the School of Forestry and Environmental Studies, the center combines the efforts of a small permanent faculty with participation by business leaders, government officials, and the faculty and students of Duke University and other universities to provide a center of excellence for the analysis of contemporary resource and environmental policy issues, a forum for the examination of public and private responsibilities for natural resources and the environment, and a link between the specialized knowledge of academia and the information needs of government and industry. Graduate research assistantships are offered to qualified students researching resource and environmental policy problems. Support is available to students pursuing M.S., A.M., or Ph.D. degrees through the Graduate School at Duke University and in conjunction with the School of Forestry and Environmental Studies or other departments. Course work is offered in both intensive (one to three weeks) and semester-long formats. For further information, write to Dr. Robert Healy, Center for Resource and Environmental Policy Research, 102 Biological Sciences Building, Duke University, Durham, North Carolina 27706.

**The University Program in Toxicology.** This interdepartmental program provides graduate students and postdoctoral fellows with an opportunity for a strong education in toxicology through support of courses, seminars, and research. The objectives of program members are to understand and devise controls for those toxicological phenomena having direct effects on human life and health, to train scholars who will advance the science of this discipline, and to provide a forum for faculty and student discussion of recent research developments. The faculty of the toxicology program is drawn from biochemistry, biological anthropology and anatomy, cell biology/physiology, chemistry, forestry and environmental studies, microbiology and immunology, neurobiology, pathology, pharmacology, zoology, and several departments in the School of Medicine. Current



areas of research include pulmonary toxicology, neurotoxicology, immunotoxicology, carcinogenesis, and biochemical toxicology. Students may base their training in general toxicology, ecotoxicology, or any area in which the faculty is currently involved. Prospective graduate students may apply to the program directly or to one of the participating departments, and must be admitted both to the department and to the program. Information on fellowship support and application procedures may be obtained from Dr. Doyle G. Graham, Director, University Program in Toxicology, Box 3712, Duke University Medical Center, Durham, North Carolina 27710.

**Organization for Tropical Studies.** Duke University is a member of an international consortium created to promote an understanding of tropical environments through research and research-training programs in the tropics. A basic eight-week OTS course in tropical biology is conducted twice a year, and advanced course offerings are scheduled periodically in agriculture, botany, forestry, geography, and zoology. For information, consult Dr. Donald Stone or Dr. Richard White, Department of Botany; or Dr. John Lundberg, Department of Zoology; Duke University, Durham, North Carolina 27706.

**Short Courses and Conferences.** Short courses, institutes, and conferences are conducted throughout the year by the Office of Continuing Education. Some are residential, others are designed for local participants; some carry continuing education units (CEUs). Programs include the Duke Young Writers' Camp, Writers' Conferences, and Product Safety Seminars. Contact Dr. Judith Ruderman, Director, Office of Continuing Education, The Bishop's House, Duke University, Durham, North Carolina 27708, for brochures describing current offerings.

**Duke Summer Festival of the Arts.** The Duke Summer Festival of Creative Arts is administered jointly by the Summer Session Office and the Office of Cultural Affairs. The festival provides an exciting, artistically stimulating environment for the campus and community. The Ciompi Quartet, Duke's well-known Chamber Music Ensemble, will give several performances. Other special events such as jazz concerts, carillon recitals, dance and theater performances, and film series are planned. Specific course listings can be found under art, dance, drama, and music.

**The American Dance Festival.** The six-week program offers a wide variety of classes, performances, and workshops. For a catalog, write to the American Dance Festival, Duke University, Box 6097 College Station, Durham, North Carolina 27708.

**Summer Theater Institute.** The Summer Theater Institute, for students seriously interested in theater, offers intense professional-level training and experience. Courses involve substantial contact time and carefully prepared assignments. Opportunities for students to be involved in professional theater activities are planned. Courses are open primarily to Duke students, but with special permission of the Director of Drama, students from other institutions may attend. Detailed information on faculty and courses may be obtained from the Summer Theater Institute, 206 Bivins Building, Duke University, Durham, North Carolina 27706.

## General Regulations Governing Graduate Studies

The official, detailed *Bulletin of Duke University: Graduate School*, published in March of each year, gives an account of regulations concerning graduate work at Duke University and a full description of course content. The following pages are a summary of these materials for 1989-90 and should provide sufficient information, together with the application packet, for the prospective student. The bulletin is normally mailed to each student who is admitted to the Graduate School in the late spring of the year of matriculation so that the course program may be planned for the first year.

## Admission

All students seeking a graduate degree from Duke University must formally be admitted to the Graduate School. Applicants are considered without regard to race, color, religion, national origin, handicap, veteran status, sexual orientation or preference, sex, or age.

Prerequisites for admission include a bachelor's degree (or the equivalent) from an accredited institution. The student's undergraduate background should be well-rounded and of high quality, indicating ability for graduate study. Ordinarily the student should have majored in the area of intended graduate study. Many departments (see the section on "Advanced Degree Programs") list specific prerequisites. Satisfactory scores on the Graduate Record Examination are required by all departments.

Many graduate departments will consider applications from students wishing to pursue degree study on a full-time or part-time basis. (Consult application materials for listing of departments.) Admission requirements, procedures, and deadlines are the same for both full- and part-time students. Part-time study requires a minimum registration of 3 units per semester, and while it is possible to obtain the master's degree on a totally part-time basis, the Ph.D. degree does require a minimum of one year of full-time residence. Additionally, students must maintain continuous registration from entry into the Graduate School to completion of degree. Time limits for completion of degrees are the same for both full- and part-time students. Financial aid through Duke University is not available to part-time students (except during their year of full-time residence). Visa restrictions do not allow nonimmigrant students to pursue graduate study on a part-time basis.

Students who do not intend to earn an advanced degree at Duke, but who wish to take graduate courses, may apply for nondegree admission. Such admission is granted in three different categories: (1) admission as a regular nondegree student in the Graduate School, which involves application to a particular department and fulfillment of standard application procedures and requirements; (2) admission as a special nondegree student through the Office of Continuing Education in conjunction with the Graduate School, without departmental affiliation, following special application procedures; and (3) admission as an unclassified student in the summer session only, requiring application to the Director of the Summer Session.

**Procedures.** A student seeking admission to the Graduate School should obtain an application packet from the Graduate School Admissions Office. (Note: Persons interested in the Master of Arts in Liberal Studies should contact that program directly for information, requirements, and special application materials.) This packet contains the necessary forms and detailed application instructions. The application form and accompanying Summary Data sheet must be filled out completely, signed, and returned to the Graduate Admissions Office accompanied by a nonrefundable fee of \$50 in U.S. currency (check or money order payable to Duke University through a U.S. bank). In addition, the student must provide the following supporting documents: (1) two copies of the official, confidential transcript from each post-secondary institution attended sent directly to the Graduate School by the institution; (2) three letters of evaluation from persons best qualified to judge the applicant as a prospective graduate student, written on the forms provided and returned by the applicant in the confidential envelopes that have been sealed-then-signed by the evaluators (or returned directly to the Graduate School by the evaluator); (3) official scores on the Graduate Record Examination General Test for applicants to all departments; and (4) official scores on the Graduate Record Examination Subject Test for applicants to certain specified departments. Please consult the current application packet for more detailed information on all requirements.

Students applying for fall admission and award should take the Graduate Record Examination no later than the October testing in the previous year to meet our deadlines. Information on the times and places of the Graduate Record Examination can be provided

by the applicant's college or by the Educational Testing Service, P.O. Box 6000, Princeton, New Jersey 08541-6000.

Applications cannot be reviewed until all supporting documents are on file. *Materials submitted in support of an application are not released for other purposes and cannot be returned to the applicant.*

Fully qualified students from outside the United States may apply for admission to full-time study in the Graduate School. The foreign student must, in addition to the information required of all students, submit the following materials with the application: (1) if the student's native language is not English, certification of English proficiency demonstrated by official scores from the Test of English as a Foreign Language (TOEFL), administered through the Educational Testing Service, P.O. Box 6155, Princeton, New Jersey 08541-6155 (the Graduate School requires a score of 550 or higher on the TOEFL); (2) a statement showing financial arrangements for the proposed term at Duke (estimated costs per calendar year are about \$19,500). Foreign students may apply for full-time study only.

During new matriculants' first registration period at Duke, every foreign student whose native language is not English will be required to take a test to verify competence in the use of oral and written English. Students found to lack the necessary competence will be expected to undertake additional English language instruction. Students who do not perform satisfactorily on the test for competence in oral and written English by the end of their first year of residency will not be permitted to continue graduate work at Duke University. Please note that the competency test does not take the place of the TOEFL 550 requirement, nor does passing the competency examination meet degree requirements for a foreign language.

It is the applicant's responsibility to make certain that the Graduate School Office has received all required materials before the specified deadlines, which are outlined at the close of this chapter and detailed in the application materials. To ensure that the Admissions Office will have adequate time to assemble all items submitted on an applicant's behalf, applications should be submitted at least two weeks before the deadline. Only complete applications can be considered. Anyone whose folder is not complete by the deadline will face the possibility that departmental enrollment will have been filled and that all financial aid funds will have been committed based on applications that were complete as of the deadline.

Application files are assembled in the Graduate School Admissions Office, where all official record-keeping is maintained. Applications, when complete, are sent to the departments. A departmental admissions committee, usually headed by the Director of Graduate Studies, reviews the applications and makes recommendations to the Dean. Formal admission to the Graduate School is offered only by the Dean, who will send the official letter of admission and an acceptance form. The process of admission is not complete until the student returns the acceptance form. An admission offer is only for the semester specified in the letter of admission; admission may not be deferred from one term to another.

**Immunizations.** North Carolina Statute G.S.: 130A-155.1 states that no person shall attend a college or university, public, private, or religious, excluding students attending night classes only and students matriculating in off-campus courses, unless a certificate of immunizations against diphtheria, tetanus, whooping cough, poliomyelitis, red measles (rubeola), and rubella is presented to the college or university on or before the first day of matriculation. The required forms and instructions are provided to students in the packet of materials sent with the letter of admission.





## Earning the Degrees

Duke University offers graduate programs leading to the specified advanced degrees in the following fields:\*

Biochemical Engineering, M.S., Ph.D.	History, A.M., Ph.D.
Biochemistry, Ph.D.	Humanities, A.M.
Biological Anthropology and Anatomy, Ph.D.	Liberal Studies, A.M.
Biomedical Engineering, M.S., Ph.D.	Literature, Ph.D.
Botany, Ph.D.	Mathematics, A.M., Ph.D.
Business Administration, Ph.D.	Mechanical Engineering and Materials Science, M.S., Ph.D.
Cell Biology, Ph.D.	Microbiology and Immunology, Ph.D.
Chemistry, Ph.D.	Music, A.M., Ph.D.
Civil and Environmental Engineering, M.S., Ph.D.	Neurobiology, Ph.D.
Classical Studies, Ph.D.	Pathology, Ph.D.
Computer Science, Ph.D.	Pharmacology, Ph.D.
Cultural Anthropology, Ph.D.	Philosophy, Ph.D.
Economics, A.M., Ph.D.	Physical Therapy, M.S.
Electrical Engineering, M.S., Ph.D.	Physics, Ph.D.
English, Ph.D.	Political Science, A.M., Ph.D.
Forestry and Environmental Studies, A.M., M.S., Ph.D.	Psychology, Ph.D.
Geology, M.S., Ph.D.	Public Policy Studies, A.M.
Germanic Languages and Literature, A.M.	Religion, A.M., Ph.D.
Health Administration, M.H.A.	Romance Studies, A.M., Ph.D.
	Sociology, Ph.D.
	Statistics and Decision Sciences, Ph.D.
	Zoology, Ph.D.

## The Language Requirement

Although individual departments establish their own requirements (see individual departmental headnotes in the section on "Advanced Degree Programs"), the regulations of the Graduate School require no foreign language for the master's degree or for the Ph.D. degree. The languages normally required by departments are French, German, and Russian, but others may be offered if appropriate and approved.

Advanced level, noncredit, reading courses in French and German are provided for students who need them.

Foreign students whose native language is not English may, with the approval of the Director of Graduate Studies in their major department, substitute English for a foreign language required by their department for a master's or doctoral program.

## Other Requirements

The general requirement for a master's degree is a minimum of 30 units (semester hours) of course/seminar/research credit. The student must present acceptable grades for a minimum of 24 units of graduate courses. The nature of the additional 6 units for which students must register depends on whether they are enrolled in thesis or nonthesis programs; i.e., these last 6 units are earned either with successful submission of the thesis or with such other courses or academic exercises as are approved by the student's department.

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\*Students interested in additional information on departmental programs not furnished in the *Bulletin of Duke University: Graduate School* should contact the Director of Graduate Studies in the appropriate department.

A master's program can be completed in one academic year, but the student who presents a thesis usually needs at least a calendar year, and foreign students should be prepared to study for two years. The maximum length of time permitted from first registration to completion of all requirements is six years. Under certain circumstances a maximum credit of 6 units may be transferred toward the master's degree for graduate courses completed elsewhere, provided the grades earned in the particular courses were not less than *B* or the equivalent. In such a case, however, the transfer of graduate credit does not reduce the required minimum registration for a master's degree at Duke.

The course/seminar/research requirement in the doctoral program is 60 units, but the proportions of course/seminar work and research are generally flexible, based on individual needs. Those applicants with recent master's degrees, after establishing quality work here, may be granted transfer credit up to a maximum of 15 units. The dissertation is expected to be a mature and competent piece of writing, embodying the results of original and significant research. All dissertations will be published on microfilm and the author may retain copyright privileges.

Time limitations are set for the completion of the doctoral program. The preliminary examination, which may be taken only after language, course/seminar, and residence requirements have been met, formally admits a student to candidacy for the degree. This examination should be passed by the end of the third year of doctoral study. The interval between preliminary examination and presentation of an acceptable dissertation should ordinarily be one to two years and may not be more than four years without special approval by the Dean. Should this interval extend beyond five years, a second preliminary examination usually becomes necessary.

## Financial Information\*

Tuition and fees are charged at the rate of \$320 per unit (a unit is equivalent to a semester hour), with the normal full program of study being 24 units for an academic year. The basic necessary expenses for a year of graduate study, assuming one lives in University graduate housing, are approximately as follows:

Registration Fee	\$ 900
Tuition	7,680
Health Fee	252
Room Rent†	
(Central Campus Apartments)	2,442
Meals‡	2,460

†Depending upon accommodations chosen.

‡Cafeteria estimate.

Normally, a doctoral student will not pay tuition beyond 60 units of degree credit. Additional allowances should be made for books, laundry, and other personal expenditures.

Apartment accommodations for graduate and professional students are available in the Central Campus Apartments, the Town House Apartments, and modular homes, all of which are conveniently located close to East and West Campus. Two- and three-bedroom apartments are available furnished or unfurnished. In addition to University housing, the Central Campus office maintains an off-campus listing service which provides a list of privately owned homes, apartments, duplexes, and efficiencies for rent in Durham.

Duke University does not have a deferred payment plan for tuition, fees, and other charges. Students are expected to pay tuition and fees at the time of matriculation unless they plan to pay via payroll deduction from payments received for fellowships, assistantships, or employment. Graduate students who receive payments from the University and

\*The figures contained in this section are subject to change prior to the beginning of the fall, 1989, semester.



who plan to pay tuition and fees and/or campus housing charges via payroll deduction must make arrangements in the Bursar's office for such deduction.

**Financial Aid.** In recent years at Duke about two-thirds of all full-time students have held an award of some type. Part-time students are not eligible for financial aid from the University.

The student who seeks financial aid from Duke University should be certain that the request for admission and award is filed not later than February 1 of the year in which September admission is sought. (The deadline is January 15 for psychology.) The application for admission, including transcripts of previous college work and letters of evaluation, is processed by the Graduate School and forwarded to the department in which the student wishes to pursue advanced work. The graduate faculty—or admissions committee—in the department reviews all applications and then makes its recommendation to the Dean for announcement in late March. The most outstanding applicants are then offered awards; the next in order of rank are placed on an alternate list for awards. Other students are offered only admission to the Graduate School. Because of multiple applications by students, a fraction of the awards offered by any graduate school are not accepted. Alternates on the award list are immediately notified, and the process continues until the available number of awards has been made.

Awards to entering students at Duke are in the form of fellowships, scholarships, and assistantships. Students holding awards usually are paid in nine equal installments beginning in late September.

**James B. Duke Graduate Fellowships** are provided through the Duke Endowment. Fellows are chosen from nominations made by the departments. Only outstanding applicants who are seeking the Ph.D. degree are considered. These nominations are made in late February and are judged in a competition which includes candidates from all departments granting the Ph.D. degree. The fellowships provide for payment of tuition for full registration and a stipend of \$1,000 per month for twelve months for the duration of the award. The award requires no service beyond that which is required of all students in a given department as a part of their training and is renewable each year upon satisfactory progress toward the degree at a fellowship level of quality. The total value of a James B. Duke Fellowship over the full three years of tenure is over \$62,000 at current tuition rates.

**Graduate Fellowships** range in value to \$19,000 for the calendar year and are made on a year-to-year basis. They are awarded upon recommendation by each department. No service is required as a prerequisite for accepting a fellowship, but all fellowship holders are expected to maintain full-time registration.

**Special Graduate Fellowships for Minority Students** provide for payment of tuition plus a stipend of up to \$900 per month for nine months. They are awarded to qualified applicants upon the recommendation of the department.

**Graduate Scholarships** provide for payment of tuition or partial tuition. Full tuition scholarships are valued at \$8,038 for the academic year. Scholarships are awarded upon the recommendation of each department.

**Graduate Assistantships** range in value to \$18,000 for the academic year. Assistants are normally permitted to reduce their registration to 9 units, and residence credit as a full-time student is allowed under these circumstances. Assistantships are most common in the science departments, where the student often provides laboratory assistance to various members of the faculty. Most graduate assistants remain in residence during the summer sessions carrying research or course credit. In this way, the normal progress toward a degree is not impeded by the reduced load during the fall and spring semesters. Departmental research funds are often available to provide financial assistance during the summer.

Other graduate fellowships are available from foundations, industry, or the government. Among those at the University's disposal are: Kearns fellowships in religion, Mellon fellowships and traineeships under a grant from the Office of Education for students in the Canadian Studies Program, and Medieval and Renaissance Studies fellowships. Over 300 other traineeships and assistantships are available in the biological, physical, and social sciences under grants from the National Institutes of Health, National Institutes of Mental Health, National Science Foundation, research agencies in the Department of Defense, and other governmental agencies.

**Loans.** Students who anticipate the need to supplement their financial resources through loans should contact their state lending agencies or banks which provide loans through the Stafford Student Loan Program. Students should contact the Graduate School Financial Aid Office for information concerning obtaining the Stafford Student Loan if they have problems establishing residency or locating a lender in their home states.

It is the policy of the Graduate School to provide loans through the University to help students meet their educational expenses. Students with full-time status who meet the federal criteria for need and who have applied for loans from their state agencies are eligible for loans through the University. Loan funds are provided through the Stafford Student Loan Program and the Perkins Loan (formerly National Direct Student Loan Program). Generally, loans made from these funds or the state lending agencies bear no interest charge to qualified borrowers while they maintain student status and for a short period thereafter. Interest during the repayment period is at a generally favorable rate.

Inquiries concerning loans should indicate the department of intended matriculation and include all pertinent information concerning application to a state agency. These inquiries should be addressed to the Financial Aid Coordinator, Graduate School, Duke University, Durham, North Carolina 27706.

The costs of graduate education are high, but Duke University attempts to allocate its funds so that the superior student is able to finish work for a degree in the normal length of time regardless of personal financial resources. This is a contribution to the community of scholarship which the University is glad to bear.

The applicant who wishes further information on facilities and regulations on course programs not covered in this bulletin is invited to write to the Dean of the Graduate School, or the Director of Graduate Studies in the department of intended study.





# Calendar of the Graduate School

## Summer Session 1989

First Term: May 18-July 1

Second Term: July 5-August 18

## Academic Year 1989-90

First Semester: August 28- December 16

Second Semester: January 11- May 5

August 22-23	Registration for first semester
August 28	Classes begin
October 13-18	Fall break
November 22-27	Thanksgiving recess
December 2-10	Reading period*
December 16	End of first semester
January 10	Registration for second semester
January 11	Classes begin
March 9-19	Spring recess
April 21-29	Reading period*
May 5	End of second semester
May 11-13	Commencement

## Special Deadlines for Admission Applicants

*Consult current application materials for a more detailed explanation of deadlines and their enforcement.*

July 15, 1989	Last day for completion of applications for admission to the fall 1989 semester (for those departments with space available)
November 1, 1989	Last day for completion of applications to the spring 1990 semester
January 12, 1990, 5:00 P.M.	Deadline for completion of applications to specified programs (see application materials), fall 1990
January 31, 1990, 5:00 P.M.	Deadline for completion of applications for admission and award to all other programs for the fall 1990 semester
April 15, 1990	Last day for completion of applications for first summer session 1990
May 15, 1990	Last day for completion of applications for second summer session, 1990
July 15, 1990	Last day for completion of applications for admission to the fall 1990 semester (for those departments with space available)

\*For 200-level courses, the length of the reading period is at the discretion of the instructor.

†Students seeking admission to the Graduate School for study in the summer session should apply to the Dean of the Graduate School and to the Director of the Summer Session.



# Advanced Degree Programs

## Art and Art History

Professor John R. Spencer, Ph.D. (Yale), *Director of Graduate Studies*

### Associate Professors

Caroline A. Bruzelius, Ph.D. (Yale); Annabel Wharton, Ph.D. (Courtauld Institute, University of London)

### Assistant Professors

David Castriota, Ph.D. (Columbia); Claude Cernuschi, Ph.D. (New York University); Kristine Stiles, Ph.D. (University of California, Berkeley); Judy Sund, Ph.D. (Columbia); Hans van Miegroet, Ph.D. (University of California, Santa Barbara)

### Professor Emeritus

Sidney David Markman, Ph.D. (Columbia)

Graduate work in the Department of Art and Art History is offered leading to the A.M. degree in art history and is designed to provide basic training in the history of art with specialization in a given field selected by the student after consultation with and approval by the Director of Graduate Studies. Prospective students should present a minimum of 24 semester hours of undergraduate work in the history of art. In special cases a student who does not fulfill this prerequisite may be required to attend prescribed undergraduate courses. A reading knowledge of one foreign language (preferably German) is required; candidates who do not meet this requirement upon admission to the program are expected to do so by the end of their first term in residence.

The program for the A.M. degree in art history consists of 30 units as follows: 12 units in art history; 6 units in an approved minor; 6 units in the major or minor, or other approved subject; and 6 units in thesis. A written thesis is required.



## Courses of Instruction

220S. Studies in Greek Art  
221S. Studies in Roman Art  
222S. Greek Sculpture  
223S. Greek Painting  
224S. Greek Architecture  
225S. Roman Architecture  
226S. Roman Painting  
230S. Medieval and Byzantine Art and Architecture  
232S. Romanesque and Gothic Art and Architecture  
234. Medieval Architecture  
235. Gothic Cathedrals  
241. Fifteenth-Century Italian Art  
242S. Studies in Italian Renaissance Art  
243S. Studies in Northern Art  
251. Italian Baroque Art  
252. Northern Baroque Painting  
261S. Studies in Romanticism

262S. Studies in Nineteenth-Century Art  
274. The History of Impressionism  
275. Surrealism  
276S. Problems in Modern Art  
278. Twentieth-Century Criticism  
282S. Contemporary Theory in the Visual Arts  
293S. Methodology of Art History  
294, 295. Special Problems in Art History

## Courses Currently Unscheduled

227. Early Christian Culture: Evidence of Art and Literature  
231. Byzantine Art and Architecture  
245. Sixteenth-Century Italian Art  
248. Art of Northern Europe in the Fifteenth and Sixteenth Centuries  
279S. Problems in Modern Architecture

## Asian Languages

The courses are offered as an enrichment for students interested in the South Asian subcontinent. See the announcement for the Asian-Pacific Studies Institute in this bulletin in the section on special programs. For courses in Chinese and Japanese, see the *Bulletin of Duke University: Undergraduate Instruction*.

## Courses Currently Unscheduled

Hindi-Urdu 200, 201. Special Studies in South Asian Languages  
Hindi-Urdu 203. Studies in Commonwealth Literature

## Biochemistry

Professor Robert L. Hill, Ph.D. (Kansas), *James B. Duke Professor of Biochemistry and Chairman*  
Professor Robert E. Webster, Ph.D. (Duke), *Director of Graduate Studies*

### Professors

Robert Bell, Ph.D. (California at Berkeley), *James B. Duke Professor of Biochemistry*; Vann Bennett, M.D., Ph.D. (Johns Hopkins); Irwin Fridovich, Ph.D. (Duke), *James B. Duke Professor of Biochemistry*; Samson R. Gross, Ph.D. (Columbia); Nicholas M. Kredich, M.D. (Michigan); Robert J. Lefkowitz, M.D. (Columbia); Kenneth S. McCarty, Ph.D. (Columbia); Paul L. Modrich, Ph.D. (Stanford), *James B. Duke Professor of Biochemistry*; K. V. Rajagopalan, Ph.D. (Univ. of Madras); Lewis M. Siegel, Ph.D. (Johns Hopkins); Leonard Spicer, Ph.D. (Yale)

### Associate Professors

Ronald C. Greene, Ph.D. (California Inst. of Tech.); Arno L. Greenleaf, Ph.D. (Harvard); Edward Holmes, M.D. (Pennsylvania); Tao-shih Hsieh, Ph.D. (California at Berkeley); Bernard Kaufman, Ph.D. (Indiana); David C. Richardson, Ph.D. (Massachusetts Inst. of Tech.); Harvey J. Sage, Ph.D. (Yale); Deborah A. Steege, Ph.D. (Yale); James B. Sullivan, Ph.D. (Texas)

### Assistant Professors

Michael Been, Ph.D. (University of Washington, Seattle); Perry J. Blackshear, M.D. (Harvard); Carol Fierke, Ph.D. (Brandeis); Michael S. Hershfield, M.D. (Pennsylvania); Russel E. Kaufman, M.D. (Ohio State University); David M. Schlossman, Ph.D. (Duke)

### Professor Emeritus

Mary L. C. Bernheim, Ph.D. (Univ. of Cambridge)

### Associate Medical Research Professor

Jane Richardson, M.A.T. (Harvard)

Graduate work in the Department of Biochemistry is offered leading to the Ph.D. degree. Preparation for such graduate study may take diverse forms. Undergraduate majors in chemistry, biology, mathematics, or physics are welcome, but adequate preparation in chemistry is essential. Graduate specialization areas include protein structure and function, crystallography of macromolecules, nucleic acid structure and function, lipid bio-

chemistry, membrane structure and function, molecular genetics, and enzyme mechanisms. The biochemistry department, in cooperation with the University Program in Genetics and the University Program in Cell and Molecular Biology, offers biochemistry students the opportunity to pursue advanced research and study to fulfill the requirements for the Ph.D. degree related to these fields.

### Courses of Instruction

200. General Biochemistry  
209, 210. Independent Study  
215. Genetic Mechanisms  
219. Molecular and Cellular Bases of Differentiation  
219S. Seminar  
222. Structure of Biological Macromolecules  
224. Biochemistry of Development and Differentiation  
227. Introductory Biochemistry I: Intermediary Metabolism  
259. Molecular Biology I: Proteins and Enzymes  
265S, 266S. Seminar

268. Molecular Biology II: Nucleic Acids  
286. Current Topics in Immunochemistry  
288. The Carbohydrates and Lipids of Biological Systems  
291. Physical Biochemistry  
297. Intermediary Metabolism  
345, 346. Biochemistry Seminar

### Courses Currently Unscheduled

245L. Macromolecules, Ecology, and Evolution  
276. Comparative and Evolutionary Biochemistry

## Biological Anthropology and Anatomy

Professor Richard F. Kay, Ph.D. (Yale), *Chairman*

Associate Professor Kathleen Smith, Ph.D. (Harvard), *Director of Graduate Studies*

### Professors

Matt Cartmill, Ph.D. (Chicago); William Hylander, Ph.D. (Chicago); Elwyn Simons, Ph.D. (Princeton), D.Phil. (University Coll., Oxford), *James B. Duke Professor of Biological Anthropology and Anatomy*; John Terborgh, Ph.D. (Harvard)

### Associate Professors

Kenneth Glander, Ph.D. (Chicago); Carel van Schaik, Ph.D. (Utrecht)

### Assistant Professors

Frank H. Bassett III, M.D. (Louisville); V. Louise Roth, Ph.D. (Yale); Patricia Wright, Ph.D. (CUNY)

### Professor Emeritus

Weston LaBarre, Ph.D. (Yale), *James B. Duke Professor Emeritus of Anthropology*

### Associate Professor Emeritus

Kenneth Duke, Ph.D. (Duke)

### Visiting Assistant Professor

Frances J. White, Ph.D. (SUNY, Stony Brook)

The Department of Biological Anthropology and Anatomy aims to provide students with a broad background for the study of behavior, ecology, physiology, morphology, systematics, and evolution. The major focus of the department is primatology; however, students are encouraged to define courses of study that cross traditional boundaries of subject matter or taxa. The department accepts students only for Ph.D. study. Applicants will be considered regardless of undergraduate major, although it is expected that students will have a background in evolution, ecology, behavior, or morphology.

The focus of the department and current research opportunities are in three major areas: (A) Behavior and ecology of living primates. Field studies are underway in Borneo, the Philippines, Central and South America, and Madagascar. Studies of behavior and breeding on a large and diverse array of captive prosimian primates from Africa, Asia, and Madagascar are being actively pursued at the Duke University Center for the Study of Primate Biology and History. (B) Functional anatomy and evolution of mammals. Current faculty are studying the relation between tooth form and diet, the functional significance of the primate and human masticatory system, and the development, function, and evolution of oral-facial musculature in vertebrates. (C) The phylogeny of mammals and primates. The faculty is conducting paleontological expeditions in Africa, Madagascar, North America, and Central and South America to recover new fossil remains to document the evolution of primates and other mammals over the past 65 million years. This work is coordinated with study of the relationships among living species based on anatomy and development.

Further information on the program is contained in *The Guide to Graduate Studies in Biological Anthropology and Anatomy*, available from the Director of Graduate Studies.

### Courses of Instruction

- |   |  |
|---|--|
| 238. Functional and Evolutionary Morphology of Primates | 305. Gross Human Anatomy                             |
| 244S. Primate Behavior                                  | 312. Research  |
| 246S. The Primate Fossil Record                         | 313. Anatomy Seminar                                 |
| 272S. Primate Anatomy                                   | 314. Biological Anthropology Seminar                 |
| 280S, 281S. Seminar in Selected Topics                  | 334. Topics in Physical Anthropology                 |
| 292. Topics in Morphology and Evolution                 | 340. Tutorial in Advanced Anatomy                    |
| 301. Anatomy of the Limbs                               | 354. Research in Biological Anthropology and Anatomy |

## Botany

Professor William L. Culberson, Ph.D. (Wisconsin), *Hugo L. Blomquist Professor of Botany and Chairman*  
Professor William H. Schlesinger, Ph.D. (Cornell), *Director of Graduate Studies*

### Professors

Janis Antonovics, Ph.D. (Univ. Coll. of North Wales), *James J. Wolfe Professor of Botany*; John E. Boynton, Ph.D. (California at Davis); Norman L. Christensen, Jr., Ph.D. (California at Santa Barbara); C. Barry Osmond, Ph.D. (Univ. of Adelaide), *Arts and Sciences Distinguished Professor of Botany*; Joseph S. Ramus, Ph.D. (California at Berkeley); Richard B. Searles, Ph.D. (California at Berkeley); James N. Siedow, Ph.D. (Indiana); Donald E. Stone, Ph.D. (California at Berkeley); Boyd R. Strain, Ph.D. (California at Los Angeles); Richard A. White, Ph.D. (Michigan); Robert L. Wilbur, Ph.D. (Michigan)

### Associate Professor

Kenneth R. Knoerr, Ph.D. (Yale)

### Assistant Professors

Stephen A. Johnston, Ph.D. (Wisconsin); Bruce D. Kohorn, Ph.D. (Yale); Brent D. Mishler, Ph.D. (Harvard); Rytas Vilgalys, Ph.D. (Virginia Polytechnic and State Univ.)

### Professors Emeriti

Lewis Edward Anderson, Ph.D. (Pennsylvania); William D. Billings, Ph.D. (Duke), *James B. Duke Professor Emeritus of Botany*; Henry Hellmers, Ph.D. (California at Berkeley); Paul J. Kramer, Ph.D. (Ohio State), *James B. Duke Professor Emeritus of Botany*; Aubrey Willard Naylor, Ph.D. (Chicago), *James B. Duke Professor Emeritus of Botany*; Jane Philpott, Ph.D. (Iowa)

### Adjunct Professor

Chicita F. Culberson, Ph.D. (Duke)

### Adjunct Associate Professor

David T. Patterson, Ph.D. (Duke)

Graduate work in the Department of Botany is offered leading to the A.M. (nonthesis), M.S. (thesis), and Ph.D. degrees. Students entering the graduate program in botany normally have a broad background in the botanical or biological sciences supplemented with basic courses in chemistry, mathematics, and physics. Biochemistry and physical chemistry are strongly recommended for students interested in molecular areas, and advanced courses in mathematics are recommended for students in population genetics and ecology. Deficiencies may be corrected by taking appropriate courses during the first year of graduate study.

Students in botany may specialize in a wide variety of areas including anatomy; cellular and molecular biology; evolution; developmental, ecological, molecular, organelle, and population genetics; physiology; community, ecosystem, physiological, and population ecology; marine biology; and the systematics of algae, fungi, lichens, bryophytes, ferns, and flowering plants. Students' programs are tailored to individual needs. A brochure providing detailed information on the Botany Department is available from the Director of Graduate Studies.

### Courses of Instruction

- |                                     |                                   |
|-------------------------------------|-----------------------------------|
| 205. Molecular Biology              | 219L. Benthic Marine Algae        |
| 210L. Bryology                      | 220L. Mycology                    |
| 212L. Phycology                     | 221S. Topics in Advanced Mycology |
| 217L. Biology of Marine Macrophytes | 224T, 225T. Special Problems      |
| 218. Barrier Island Ecology         | 232. Microclimatology             |



234S. Problems in the Philosophy of Biology  
237L. Systematic Biology  
240L. Plant Diversity  
242L. Systematics  
252L. Plant Physiology  
253. Biophysical Plant Physiology  
255L. Molecular Systematics and Evolution  
256L. S. Plant Biosystematics  
261. Photosynthesis  
263L. Tropical Seaweeds  
265L. Physiological Plant Ecology  
266. Plant Population Biology  
267L. Community Ecology  
269. Advanced Cell Biology  
272. Biogeochemistry  
280. Principles of Genetics  
283. Extrachromosomal Inheritance  
285S. Ecological Genetics  
286. Evolutionary Mechanisms

287S. Macroevolution  
293L. Population Biology  
295S, 296S. Seminar  
300. Tropical Biology: An Ecological Approach  
305S, 306S. Plant Systematics Seminar  
310S, 311S. Plant Ecology Seminar  
315S, 316S. Population Genetics Seminar  
320S, 321S. Systematics Discussion Group  
325S, 326S. Developmental, Cellular, and Molecular Biology Seminar  
330L. Environmental Monitoring and Instrumentation  
359, 360. Research in Botany

### Courses Currently Unscheduled

209L. Lichenology  
243S. Classification of Angiosperms  
247L. Plant Ecology  
270L. Plant Anatomy  
344. Micrometeorology and Biometeorology Seminar

### Related Programs

**The University Program in Cell and Molecular Biology.** Cell and Molecular Biology courses offered by the Botany Department are an integral part of this interdepartmental program. Refer to the announcement in this bulletin under The University Program in Cell and Molecular Biology.

**University Program in Genetics.** Genetics courses offered by the botany department are an integral part of this interdepartmental program. Refer to the announcement in this bulletin under The University Program in Genetics.

**Program in Tropical Biology.** Fellowships are available for travel and subsistence in field-oriented programs in Central America. Refer to Organization for Tropical Studies in the section on special programs.

**The University Program in Marine Sciences.** Interdisciplinary programs emphasizing marine botany are available. Refer to the announcement in this bulletin under The University Program in Marine Sciences.

## Business Administration

Professor Thomas F. Keller, Ph.D. (Michigan), *R. J. Reynolds Industries Professor of Business Administration and Dean*  
Professor James R. Bettman, Ph.D. (Yale), *Burlington Industries Professor of Business Administration and Director of Graduate Studies*

### Professors

Robert Ashton, Ph.D. (Minnesota); Helmy Baligh, Ph.D. (California at Berkeley); Richard M. Burton, D.B.A. (Illinois); Kalman J. Cohen, Ph.D. (Carnegie-Mellon); John D. Forsyth, D.B.A. (Illinois); Dan J. Laughhunn, D.B.A. (Illinois); Arie Y. Lewin, Ph.D. (Carnegie-Mellon); Wesley A. Magat, Ph.D. (Northwestern); Thomas H. Naylor, Ph.D. (Tulane); John W. Payne, Ph.D. (California at Irvine); Rakesh K. Sarin, Ph.D. (California at Los Angeles); Richard Staelin, Ph.D. (Michigan), *Edward and Rose Donnell Professor of Business Administration*; Robert L. Winkler, Ph.D. (Chicago), *Calvin Bryce Hoover Professor of Business Administration*

### Associate Professors

Allison Ashton, Ph.D. (Texas); Douglas T. Breeden, Ph.D. (Stanford); Julie A. Edell, Ph.D. (Carnegie-Mellon); Grant W. Gardner, Ph.D. (Harvard); Joel C. Huber, Ph.D. (Pennsylvania); John M. McCann, Ph.D. (Purdue); Joseph B. Mazzola, Ph.D. (Carnegie-Mellon); Marian Moore, Ph.D. (California at Los Angeles); William E. Ricks, Ph.D. (California at Berkeley); Blair H. Sheppard, Ph.D. (Illinois at Champaign); Anne S. Tsui, Ph.D. (California at Los Angeles); Robert E. Whaley, Ph.D. (Toronto); Valarie A. Zeithaml, Ph.D. (Maryland)

### Assistant Professors

William F. Boulding, Ph.D. (Pennsylvania); Jane L. Butt, Ph.D. (Michigan); Richard L. Daniels, Ph.D. (California at Los Angeles); Fred Feinberg, Ph.D. (Massachusetts Institute of Technology); F. Douglas Foster, Ph.D. (Cornell); Jennifer Francis, Ph.D. (Cornell); Christopher Gresov, Ph.D. (Columbia); Campbell R. Harvey, Ph.D. (University of Chicago); Michael L. Hemler, Ph.D. (University of Chicago); Amna Kirmani, Ph.D. (Stanford); Naoki Kishimoto, Ph.D. (New York University); Frederick Lindahl, Ph.D. (University of

Chicago); Kevin F. McCardle, Ph.D. (California at Los Angeles); Michael J. Moore, Ph.D. (Michigan); Robert F. Nau, Ph.D. (California at Berkeley); Donna Rae Philbrick, Ph.D. (Cornell); Devavrat Purohit, Ph.D. (Carnegie-Mellon); Elaine Romanelli, Ph.D. (Columbia); Jeffrey L. Rummel, Ph.D. (Rochester); Tom Smith, Ph.D. (Stanford); Jens A. Stephan, Ph.D. (Cornell); S. Viswanathan, Ph.D. (Northwestern)

**Adjunct Professor**

David West Peterson, Ph.D. (Stanford)

The Ph.D. in Business Administration program prepares candidates for research and teaching careers at leading educational institutions and for careers in business and governmental organizations where advanced research and analytical capabilities are required. The Ph.D. program places major emphasis on independent inquiry, on the development of competence in research methodology, and on the communication of research results.

The program requires that doctoral candidates must acquire expertise in their chosen area of study and in research methodology. This competence may be gained from course work, participation in seminars, and independent study. The student and his/her faculty committee determine the specific program of study, subject to the approval of the Director of the Doctoral Program. Each student takes a comprehensive examination at the end of the second year or at the beginning of the third year of residence. The final requirement is the presentation of a dissertation. The Ph.D. program usually requires four years of work beyond the bachelor's degree.

Refer to the *Bulletin of Duke University: The Fuqua School of Business* for a complete list of courses and course descriptions.

**Courses of Instruction**

510. Bayesian Inference and Decision  
513. Choice Theory  
521. Organization Seminar: A Micro Focus  
522. Organization Seminar: A Macro Focus  
525. Behavioral Decision Theory  
531. Financial Accounting Seminar  
532. Management Accounting Seminar  
551. Corporate Finance Seminar  
552. Investment Seminar  
553. Portfolio Theory and Asset Pricing  
561. Seminar in Quantitative Research in Marketing  
562. Seminar in Behavioral Models in Marketing  
563. Marketing Models Seminar  
571. Operations Strategy Seminar  
572. Seminar in Operational and Technological Tactics  
591. Selected Topics in Business  
597. Dissertation Research

598. Independent Study  
599. Directed Research

**Courses Currently Unscheduled**

309.1-9. Research in Managerial Economics  
319.1-9. Research in Quantitative Methods  
329.1-9. Research in Organization Theory and Management  
339.1-9. Research in Information and Accounting Systems  
349.1-9. Research in Public Policy and Social Responsibility  
359.1-9. Research in Finance  
369.1-9. Research in Marketing  
379.1-9. Research in Production  
392-393. Tutorial in Interdisciplinary Areas  
397. Dissertation Research

## The University Program in Cell and Molecular Biology

Professor Robert L. Hill, Ph.D. (Kansas), *James B. Duke Professor of Biochemistry* and *Director*  
Associate Professor Bernard Kaufman, Ph.D. (Indiana), *Associate Director*

**Professors**

David R. McClay, Ph.D. (North Carolina at Chapel Hill); Elliott Mills, Ph.D. (Columbia); Salvatore V. Pizzo, M.D., Ph.D. (Duke); James Siedow, Ph.D. (Indiana); Lewis Siegel, Ph.D. (Johns Hopkins); Sidney Simon, Ph.D. (Northwestern)

**Associate Professors**

Jack D. Keene, Ph.D. (Washington); Marc G. Caron, Ph.D. (University of Miami)

*Faculty:* A complete list of faculty, including research interests, will be made available to prospective students.

Research training in cell, developmental, and molecular biology is found in eight departments at Duke University: biochemistry, botany, cell biology/physiology, microbiology and immunology, neurobiology, pathology, pharmacology, and zoology. To effectively utilize this broad spectrum of expertise for the training of promising young scientists while still providing a coherent curriculum, the Duke University Program in Cell and Molecular Biology has been established.

During the first year of doctoral study a student will complete the program's three-course sequence presenting current understanding and research activities in cell biology and the molecular biology of nucleic acids, proteins, and membranes. Each student will also choose elective courses in an area of specialization and will have the opportunity to participate in and otherwise become acquainted with research programs of the faculty. Research training is stressed throughout the program and dissertation research usually begins by the third semester.

Prospective students may apply directly to the Cell and Molecular Biology Program or to one of the eight participating departments. Applicants must have demonstrated, in addition to overall academic excellence, a proficiency in the biological and physical sciences. Applications for admission and fellowship support must be received by February 1, but early applications may receive earlier consideration.

### Courses of Instruction

259. Molecular Biology I: Proteins and Enzymes

264. Cell and Molecular Biology Seminar

268. Molecular Biology II: Nucleic Acids

269. Advanced Cell Biology

## Cell Biology

Professor Harold P. Erickson, Ph.D. (Johns Hopkins), *Acting Chairman*

Professor Melvyn Lieberman, Ph.D. (SUNY-Downstate Medical Center), *Director of Graduate Studies*

### Professors

Marc G. Caron, Ph.D. (Miami); Shelia J. Counce, Ph.D. (Edinburgh); Edward A. Johnson, M.D. (Sheffield); Montrose J. Moses, Ph.D. (Columbia); R. Bruce Nicklas, Ph.D. (Columbia); George M. Padilla, Ph.D. (UCLA); Michael K. Reedy, M.D. (University of Washington); J. David Robertson, M.D. (Harvard), Ph.D. (Massachusetts Institute of Technology)

### Associate Professors

Celia Bonaventura, Ph.D. (Texas); Joseph Bonaventura, Ph.D. (Texas); Joseph M. Corless, M.D., Ph.D. (Duke); Eric L. Effman, M.D. (Indiana); J. Mailen Kootsey, Ph.D. (Brown); Thomas J. McIntosh, Ph.D. (Carnegie-Mellon); Frederick H. Schachat, Ph.D. (Stanford); David W. Schomber, Ph.D. (Purdue)

### Assistant Professors

Yair Argon, Ph.D. (Harvard); William E. Garrett, Jr., M.D., Ph.D. (Duke); Emma R. Jakoi, Ph.D. (Duke); Michael K. Lamvik, Ph.D. (Chicago); Patricia M. Saling, Ph.D. (Pennsylvania)

### Associate Medical Research Professor

Kenneth A. Taylor, Ph.D. (California at Berkeley)

### Assistant Medical Research Professors

Allen Dearry, Ph.D. (Pennsylvania); Rebecca J. Van Benedon, Ph.D. (Johns Hopkins)

### Adjunct Assistant Professors

Hie Ping Beall, Ph.D. (Tulane); David A. Kopf, Ph.D. (Chicago)

## Division of Physiology

Professor J. Joseph Blum, Ph.D. (Chicago), *Division Head*

### Professors

Enrico M. Camporesi, M.D. (Milan); John Gutknecht, Ph.D. (North Carolina at Chapel Hill); Stuart Handwerker, M.D. (Maryland); Diane L. Hatchell, Ph.D. (Marquette); Frans F. Jöbsis, Ph.D. (Michigan); Lazaro J. Mandel, Ph.D. (Pennsylvania); Thomas J. McManus, M.D. (Boston University); Robert Plonsey, Ph.D. (California at Berkeley); George Somjen, M.D. (Amsterdam), Ph.D. (New Zealand); Joachim R. Sommer, M.D. (Munich); Madison S. Spach, M.D. (Duke)

### Associate Professors

Nels C. Anderson, Jr., Ph.D. (Purdue); Joseph C. Greenfield, Jr., M.D. (Emory); Elliott Mills, Ph.D. (Columbia); Steven R. Vigna, Ph.D. (Washington)

### Assistant Professors

Page A. W. Anderson, M.D. (Duke); Vincent W. Dennis, M.D. (Georgetown); E. Ann LeFurgey, Ph.D. (North Carolina at Chapel Hill); Andrew W. Wallace, M.D. (Duke); R. Sanders Williams, M.D. (Duke); William E. Yarger, M.D. (Baylor)

### Associate Medical Research Professors

Peter G. Aitken, Ph.D. (Connecticut); Avis L. Sylvia, Ph.D. (North Carolina at Chapel Hill)

### Assistant Medical Research Professors

Wayne Gerth, Ph.D. (California at San Diego); Bruce Klitzman, Ph.D. (Virginia); Bruce Lobaugh, Ph.D. (Pennsylvania State); Alan D. Magid, Ph.D. (University of Washington)

### Adjunct Assistant Professor

Reginald D. Carter, Ph.D. (Bowman Gray)



The Department of Cell Biology offers a program of study leading to the Ph.D. degree. The goal of this program is to train independent and productive scholars in cell biology and/or physiology. The academic and research programs focus on the structural, subcellular, and cellular levels, and on the analysis of complex integrated physiological systems. Students have the opportunity to concentrate their course work and research in cell biology and physiology. In addition, graduate courses and research in developmental biology, molecular biology, biophysics, and theoretical biology are available in the department.

Students accepted to this program usually have earned a bachelor's degree in biological sciences, chemistry, or engineering, and hold a strong academic background in the physical sciences, including mathematics and biochemistry. Students may apply for admission through the Graduate School directly to the Department of Cell Biology or to the University Program in Cell and Molecular Biology. Interdepartmental programs available to students in the Department of Cell Biology include: Cell and Molecular Biology, Toxicology, Pharmacology, Genetics, Neurosciences, and the Medical Scientist Training Program.

The Ph.D. program in cell biology requires four to five years of study. The first two years are devoted primarily to a course of study that includes laboratory rotations, whereas the latter two years are devoted to research for the dissertation. The departmental course requirements for the Ph.D. degree are formulated by the Graduate Advisory Committee with sufficient flexibility to permit students to design individual programs of study in consultation with the Director of Graduate Studies. Students in the Department of Cell Biology are encouraged to expand their academic and research training by enrolling in elective courses offered by other departments in the Medical Center and the University. There is no foreign language requirement.

### Courses of Instruction

- |  |   |
|--|---|
| 200. Medical Physiology                              | 235. Advanced Research Training in Marine Molecular Biology and Biotechnology |
| 203. Introduction to Modern Physiology I             | 236. Seminar on the Cellular and Molecular Biology of Skeletal Muscle         |
| 204. Introduction to Modern Physiology II            | 259. Molecular Biology I  |
| 205. Design and Analysis of Biological Experiments   | 269. Advanced Cell Biology  |
| 210. Individual Study                                | 280. Student Seminar  |
| 217. Membrane Transport                              | 307. Microscopic Anatomy  |
| 219. Molecular and Cellular Bases of Differentiation | 312. Research   |
| 220. Developmental Biology                           | 313, 314. Departmental Seminar  |
| 225. Neurobiology of Sensory Systems                 | 340. Tutorial in Advanced Cell Biology/Physiology                             |
| 230. Cytoskeleton and Cell Motility                  | 399. Readings in Cell Biology   |
| 232. Extracellular Matrix and Cell Adhesion          |   |
| 233. Introduction to Biomedical Simulation           |   |
| 234. Methods in Physiological Simulation             |   |

## Chemistry

Professor Edward M. Arnett, Ph.D. (Pennsylvania), *R.J. Reynolds Industries Professor of Chemistry and Chairman*  
 Professor Steven Baldwin, Ph.D. (California Inst. of Tech.), *Director of Graduate Studies*

### Professors

Donald B. Chesnut, Ph.D. (California Inst. of Tech.); Alvin L. Crumbliss, Ph.D. (Northwestern); Bertram O. Fraser-Reid, Ph.D. (Alberta), *James B. Duke Professor of Chemistry*; William R. Krigbaum, Ph.D. (Illinois), *James B. Duke Professor of Chemistry*; Charles H. Lochmüller, Ph.D. (Fordham); Andrew T. McPhail, Ph.D. (Univ. of Glasgow); Richard A. Palmer, Ph.D. (Illinois); Ned Allen Porter, Ph.D. (Harvard), *James B. Duke Professor of Chemistry*; Peter Smith, Ph.D. (Univ. of Cambridge); Howard Austin Strobel, Ph.D. (Brown); Richard L. Wells, Ph.D. (Indiana); Pelham Wilder, Jr., Ph.D. (Harvard)

### Associate Professors

Robert W. Henkens, Ph.D. (Yale); Linda B. McGown, Ph.D. (Univ. of Washington); Michael C. Pirrung, Ph.D. (California at Berkeley); Barbara Ramsay Shaw, Ph.D. (Univ. of Washington)

### Assistant Professors

Richard A. MacPhail, Ph.D. (California at Berkeley); Richard P. Polniaszek, Ph.D. (UCLA); Michael G. Prisant, Ph.D. (Stanford); Weitao Yang, Ph.D. (North Carolina at Chapel Hill)

### Professors Emeriti

Charles Kilgo Bradsher, Ph.D. (Harvard); Frances C. Brown, Ph.D. (Johns Hopkins); Marcus E. Hobbs, Ph.D. (Duke); Jacques C. Poirier, Ph.D. (Chicago); Louis DuBose Quin, Ph.D. (North Carolina at Chapel Hill), *James B. Duke Professor Emeritus of Chemistry*

### Adjunct Professors

Robert G. Ghirardelli, Ph.D. (California Inst. of Tech.); Peter W. Jeffs, Ph.D. (Univ. of Natal); Eugene Magat, Ph.D. (Mass. Inst. of Technology); Colin G. Pitt, Ph.D. (Univ. of London); Bernard Spielvogel, Ph.D. (Michigan)

### Adjunct Associate Professors

David Millington, Ph.D. (University of Liverpool); George Painter, Ph.D. (Emory University)

### Adjunct Assistant Professors

Mary Ellen Switzer, Ph.D. (Illinois); Daniel D. Sternbach, Ph.D. (Brandeis)

In the Department of Chemistry graduate work is offered leading to the M.S. and Ph.D. degrees. Before undertaking a graduate program in chemistry, a student should have taken an undergraduate major in chemistry, along with related work in mathematics and physics.

Graduate courses in the department are offered in the fields of analytical, inorganic, organic, and physical chemistry. Research programs are active in all these fields.

A booklet providing detailed information on the department is available from the Director of Graduate Studies.

### Courses of Instruction

- |  |  |
|--|--|
| 201. Molecular Spectroscopy                                  | 320. Synthetic Organic Chemistry                             |
| 203. Quantum Chemistry                                       | 322. Organic Reactive Intermediates                          |
| 205. Structure and Reaction Dynamics                         | 324. Special Topics in Organic Chemistry                     |
| 207. Principles of Kinetics, Thermodynamics, and Diffraction | 330. Separation Science and Fundamental Electrochemistry     |
| 275, 276. Advanced Studies                                   | 331, 332. Special Topics in Analytical Chemistry             |
| 300. Basic Statistical Mechanics                             | 334. Chemical Instrumentation and Practical Electrochemistry |
| 302. Basic Quantum Mechanics                                 | 373, 374. Seminar  |
| 303, 304. Special Topics in Physical Chemistry               | 375, 376. Research   |
| 310. Theoretical and Structural Inorganic Chemistry          | 377. Research Orientation Seminar                            |
| 312. Inorganic Reactions and Mechanisms                      |  |
| 313. Special Topics in Inorganic Chemistry                   |  |

### Classical Studies

Professor Francis Newton, Ph.D. (North Carolina at Chapel Hill), *Chairman*  
Associate Professor Kent J. Rigsby, Society of Fellows (Harvard), *Director of Graduate Studies*

#### Professors

John F. Oates, Ph.D. (Yale); Lawrence Richardson, Jr., Ph.D. (Yale)

#### Associate Professors

Mary T. Boatwright, Ph.D. (Michigan); Peter Burian, Ph.D. (Princeton); Dennis Keith Stanley, Jr., Ph.D. (Johns Hopkins); John G. Younger, Ph.D. (Cincinnati)

#### Assistant Professor

Paul Vander Waerdt, Ph.D. (Princeton)

#### Professor Emeritus

William H. Willis, Ph.D. (Yale)

The Department of Classical Studies offers graduate work leading to the A.M. and Ph.D. degrees in classical studies. Work in the department encompasses all aspects of the Greco-Roman world: students in the program are able, through course work, directed research, and their own teaching, to prepare for careers of teaching and research as broadly trained classical scholars. For regular admission, students should offer at least three years of college study in one of the classical languages and two in the other. Before developing a specialization within the program, students are expected to acquire facility in both Greek and Latin, a broad knowledge of the literatures and of ancient history and archaeology, and command of research methods. Reading knowledge of French and German is required for the Ph.D. The resources of the department include important collections of Greek and Latin manuscripts and papyri, computer facilities in the ancient languages, and a valuable study collection of Greek and Roman art. The department pub-

lishes the journal *Greek, Roman, and Byzantine Studies*. The Director of Graduate Studies will provide on request a brochure giving further information about the department's requirements, resources, and financial aid; prospective students should also consult the general requirements of the University set forth in the section on "General Regulations Governing Graduate Studies" in this bulletin.

## Greek

### Courses of Instruction

- 200. Readings in Greek Literature
- 201. Studies in Greek Literature I
- 202. Studies in Greek Literature II
- 203. Homer
- 205. Greek Lyric Poets
- 207. The Dramatists
- 210. Hellenistic Literature
- 211S. Plato
- 217S. Aristotle

### 222. The Historians

- 301. Seminar in Greek Literature I
- 302. Seminar in Greek Literature II
- 313. Seminar in Greek Epigraphy
- 399. Directed Reading and Research

### Courses Currently Unscheduled

- 221. Early Greek Prose
- 226. The Orators
- 321. Seminar in Literary Papyri

## Latin

### Courses of Instruction

- 200. Readings in Latin Literature
- 201. Studies in Latin Literature I
- 202. Studies in Latin Literature II
- 206. Cicero
- 207S. Vergil's *Aeneid*
- 211S. Elegiac Poets
- 214. The Historians
- 301. Seminar in Latin Literature I
- 302. Seminar in Latin Literature II

### 312. Seminar in Latin Paleography

- 314. Seminar in Latin Epigraphy
- 315. Seminar in Roman Law
- 399. Directed Reading and Research

### Courses Currently Unscheduled

- 204. Epic of the Silver Age: Lucan to Statius
- 205. The Roman Novel
- 208. Lyric and Occasional Poetry
- 221. Medieval Latin

## Classical Studies (Ancient History)

### Courses of Instruction

- 222. Fifth and Fourth Century Greece
- 223. Alexander and the Hellenistic World
- 224. The Roman Republic
- 225. The Roman Empire
- 258. The Hellenistic and Roman East
- 321. Seminar in Ancient History I
- 322. Seminar in Ancient History II
- 399. Directed Reading and Research

### Courses Currently Unscheduled

- 221. Archaic Greece
- 226. Late Antiquity
- 327. Seminar in Byzantine History

## Classical Studies (Archaeology)

### Courses of Instruction

- 220S. Studies in Greek Art
- 227S. Studies in Roman Art
- 230S. Medieval and Byzantine Art and Architecture
- 231S. Greek Sculpture
- 232S. Greek Painting
- 233S. Greek Architecture
- 235S. Roman Architecture
- 236S. Roman Painting
- 311. Archaeology Seminar I
- 312. Archaeology Seminar II
- 399. Directed Reading and Research

### Courses Currently Unscheduled

- 234S. Roman Sculpture

Under the terms of a cooperative agreement, graduate students of Duke University may take appropriate graduate courses offered by the Departments of Classics or Art of the University of North Carolina. A list of these courses will be sent upon request.

## Computer Science

Professor Donald Rose, Ph.D. (Harvard), *Chairman*

Associate Professor Gershon Kedem, Ph.D. (Wisconsin), *Director of Graduate Studies*



### Professors

Alan W. Biermann, Ph.D. (California at Berkeley); Thomas M. Gallie, Ph.D. (Rice); Donald W. Loveland, Ph.D. (New York Univ.); Peter N. Marinos, Ph.D. (North Carolina State); Merrell L. Patrick, Ph.D. (Carnegie-Mellon); John H. Reif, Ph.D. (Harvard); Charles Starmer, Ph.D. (North Carolina at Chapel Hill); Kishor S. Trivedi, Ph.D. (Illinois); Senol Utku, Sc.D. (Massachusetts Inst. of Tech.)

### Associate Professors

Joanne Bechta Dugan, Ph.D. (Duke); Carla S. Ellis, Ph.D. (Washington); Henry S. Greenside, Ph.D. (Princeton); Robert A. Wagner, Ph.D. (Carnegie-Mellon)

### Assistant Professors

John A. Board, Jr., Ph.D. (Oxford); Carl L. Gardner, Ph.D. (M.I.T.); Mark A. Holliday, Ph.D. (Wisconsin); Gopalan Nadathur, Ph.D. (Pennsylvania); Daniel Szyld, Ph.D. (New York Univ.)

### Research Associate Professors

John L. Ellis, Ph.D. (Toledo); J. Mailen Kootsey, Ph.D. (Brown); Dietolf Ramm, Ph.D. (Duke)

### Adjunct Associate Professor

William M. Coughran, Jr., Ph.D. (Stanford)

The Department of Computer Science offers programs leading to the M.S. and Ph.D. degrees. The department also actively cooperates with the computer science department of the University of North Carolina at Chapel Hill.

A student entering graduate work in computer science should have had three semesters of calculus and one semester of linear algebra, and have a knowledge of data structures, and of assembler as well as higher-level computer programming languages. Research interests of present faculty include systems modeling; mathematical foundations of computer science; artificial intelligence; scientific computing (including numerical analysis); medical applications of computers; distribution and parallel operating systems; VLSI design, computer architecture, and CAD algorithms.

### Courses of Instruction

200. Programming Methodology I  
201. Programming Languages  
202. Applied Discrete Structures  
204. Computer Network Architecture  
207. Fault-Tolerant Computer Systems  
208. Digital Computer Architecture and Design  
209. Microprocessor Fundamentals and Applications  
210. Introduction to VLSI Design  
212. Introduction to Scientific Computing  
213. Introduction to Nonlinear Dynamics  
215. Artificial Intelligence  
221. Numerical Analysis  
222. Numerical Differential Equations  
223. Numerical Linear Algebra  
224. Analysis of Algorithms  
225. Formal Languages and Theory of Computation  
226. Mathematical Methods for Systems Analysis I  
227. Mathematical Methods for Systems Analysis II  
231. Operating Systems  
232. Compiler Construction  
241. Data Base Methodology  
245. Functional Analysis for Scientific Computing  
252. Computer Systems Organization  
265. Advanced Topics in Computer Science  
276. Communication, Computation, and Memory in Biological Systems

308. Advanced Topics in Digital Systems  
310. CMOS VLSI Design  
315. Advanced Topics in Artificial Intelligence  
316. Computational Linguistics  
320. VLSI Algorithmics  
321. Topics in Numerical Mathematics  
326. Systems Modeling  
331. Operating Systems Theory  
381. Seminar in Computer Systems Analysis  
382. Seminar in Artificial Intelligence

### Courses Currently Unscheduled

301. Topics in Programming Theory  
325. Theory of Computation  
332. Topics in Operating Systems

### Supplementary Courses Offered at UNC-CH

Comp 145. Software Engineering Laboratory  
Comp 171. Natural Language Processing  
Comp 230. File Management Systems  
Comp 236. Computer Graphics  
Comp 238. Raster Graphics  
Comp 254. Picture Processing and Pattern Recognition  
Comp 265. Architecture of Computers

## Cultural Anthropology

Professor Ernestine Friedl, Ph.D. (Columbia), *James B. Duke Professor of Anthropology, Chairman and Director of Graduate Studies*

### Professors

Mahadev L. Apte, Ph.D. (Wisconsin); Richard G. Fox, Ph.D. (Michigan); William O'Barr, Ph.D. (Northwestern)

### Associate Professors

Virginia R. Domínguez, Ph.D. (Yale); Naomi Quinn, Ph.D. (Stanford)

### Professor Emeritus

Weston LaBarre, Ph.D. (Yale), *James B. Duke Professor Emeritus of Anthropology*

The department offers graduate work leading to the Ph.D. degree in anthropology. Applicants for admission should submit scores on the Graduate Record Examination Aptitude Test. Admission to the program is not contingent on previous anthropological course work or any other specific program of study at the undergraduate level.

The department offers a program of specialization in social/cultural anthropology. The emphasis of the social/cultural anthropology program is the application of a theoretical and comparative perspective to research in complex societies. Within this perspective, a wide range of interests is represented in the department.

Curriculum is tailored to the individual student's background, academic needs, and research goals; pursuit of relevant cross-disciplinary study, within and outside the department, is expected. However, a modest number of courses is required of students. Candidates for the Ph.D. degree must demonstrate competence in their chosen subfield of specialization and knowledge of the broad theoretical perspectives, from all relevant disciplines, which inform their area of concentration.

Further details of the graduate program in anthropology, the departmental facilities, the staff, and various stipends available are described in the *Guidelines for Graduate Students in Anthropology* which may be obtained from the Director of Graduate Studies.

### Courses of Instruction

201S. Marxism and Anthropology  
204S. The Anthropology of Cities  
206S. Current Theoretical Schools in Anthropology  
211S. Ethnography of Communication  
215S. The Anthropology of Women: Theoretical Issues  
234S. Political Economy of Development: Theories of Change in the Third World  
239. Culture and Ideology  
251S. American Marriage: A Cultural Approach  
255S. Heroes and Heroics: Culture and the Individual

258S. Symbols in Society  
267. Cognitive Anthropology  
272S. Marxism and Feminism  
280S, 281S. Seminar in Selected Topics  
282S. Canada  
330S, 331S. Theories and Methods in Sociocultural Anthropology  
393. Individual Research in Anthropology

### Courses Currently Unscheduled

205. The Anthropology of Anthropology  
237S. Interpretations of Kinship  
275S. Inequality in Precapitalist Societies

## Economics

Professor John M. Vernon, Ph.D. (Massachusetts Institute of Technology), *Chairman*  
Professor T. Dudley Wallace, Ph.D. (Chicago), *Director of Graduate Studies*

### Professors

Charles T. Clotfelter, Ph.D. (Harvard); Phillip J. Cook, Ph.D. (California at Berkeley); David G. Davies, Ph.D. (California at Los Angeles); Neil Barry de Marchi, Ph.D. (Australian National Univ.); John F. Geweke, Ph.D. (Minnesota), *William Rand Kenan, Jr. Professor of Economics*; S. Malcolm Gillis, Ph.D. (Illinois); Craufurd D. Goodwin, Ph.D. (Duke), *James B. Duke Professor of Economics*; Henry G. Grabowski, Ph.D. (Princeton); Daniel A. Graham, Ph.D. (Duke); Thomas M. Havrilesky, Ph.D. (Illinois); Allen C. Kelley, Ph.D. (Stanford), *James B. Duke Professor of Economics*; Anne O. Krueger, Ph.D. (Wisconsin), *Distinguished Professor of Economics*; Marjorie McElroy, Ph.D. (Northwestern); Hervé J. Moulin, Ph.D. (University of Paris), *James B. Duke Professor of Economics*; Thomas H. Naylor, Ph.D. (Tulane); George E. Tauchen, Ph.D. (Minnesota); Edward Tower, Ph.D. (Harvard); Vladimir G. Treml, Ph.D. (North Carolina at Chapel Hill); Kip Viscusi, Ph.D. (Harvard), *George G. Allen Professor of Economics*; E. Roy Weintraub, Ph.D. (Pennsylvania); William P. Yohe, Ph.D. (Michigan)

### Associate Professors

Kent P. Kimbrough, Ph.D. (Chicago); Robert C. Marshall, Ph.D. (California at San Diego)

### Assistant Professors

James Baumgardner, Ph.D. (Chicago); Phillip L. Brock, Ph.D. (Stanford); Ellen C. McGrattan, Ph.D. (Stanford); Michael Meurer, Ph.D. (Minnesota); Carola Pessino, Ph.D. (Chicago); Dale O. Stahl II, Ph.D. (California at Berkeley)

### Research Professors

A. W. Coats, Ph.D. (Johns Hopkins); James Henderson, Ph.D. (Harvard)

**Adjunct Professor**

Robert H. Bates, Ph.D. (MIT); A. Ronald Gallant, Ph.D. (Iowa State University); Helen F. Ladd, Ph.D. (Harvard); Jean-François Richard, Ph.D. (Catholic University of Louvain)

**Adjunct Associate Professor**

Robert Conrad, Ph.D. (Wisconsin)

The Department of Economics offers graduate work leading to the A.M. and Ph.D. degrees. Among the undergraduate courses of distinct advantage to the graduate student in economics are statistics, economic theory, and basic courses in philosophy, mathematics, and social sciences other than economics. Advanced work in mathematics or statistics is also useful.

Requirements for the Ph.D. degree in economics include courses in economic theory, quantitative methods, and econometrics in the first year, and at the end of the second year, an examination in economic analysis. In addition, a student must obtain certification in three fields, one of which may be in an outside minor. The student may select from advanced economic theory, history of political economy, economic development, economic history, international economics, money and banking, labor economics, public finance, industrial organization, econometrics, statistics, Soviet economics, corporate economics, and certain fields outside the economics department (e.g., demography). Course work for the Ph.D. degree should be completed in five semesters of residence.

**Courses of Instruction**

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| <p>200. Capitalism and Socialism<br/>         201S, 202S. Current Issues in Economics<br/>         204S. Advanced Monetary Economics<br/>         205S. Advanced Monetary Theory and Policy<br/>         207S. Conflict and Cooperation in Economics<br/>         208S. Labor Supply and the Family<br/>         212S. Economic Science and Economic Policy<br/>         213S.1. The Economics of Slavery in the American South<br/>         214. Social Choice<br/>         218. Macroeconomic Policy<br/>         219S. Economic Problems of Underdeveloped Areas<br/>         232. Analytical Methods IV: Topics in Economic Policy<br/>         233. Federal, State, and Local Finance and Economic Policies<br/>         234. Urban and Regional Economics<br/>         243. Econometrics I<br/>         245. Econometrics II<br/>         246. Selected Topics in Econometric Theory<br/>         247S. Applied Econometrics<br/>         249. Microeconomics<br/>         250S. Modern Economic Thought<br/>         254. Macroeconomics<br/>         265S. International Trade and Finance<br/>         268. Federal Tax Policy<br/>         285. Evaluation of Public Expenditures<br/>         286S. Economic Policy-Making in Developing Countries<br/>         293. Soviet Economic History<br/>         294S. Soviet Economic System<br/>         301. Microeconomic Analysis I<br/>         302. Microeconomic Analysis II<br/>         303. Microeconomic Analysis III<br/>         304, 305. Monetary Theory and Policy<br/>         307. Quantitative Analysis I<br/>         308. Quantitative Analysis II</p> | <p>311, 312. History of Political Economy<br/>         313, 314. Seminar in Economic Theory<br/>         317. Seminar in Demographic, Population, and Resource Problems (Development Economics I)<br/>         319. Seminar in the Theory and the Problems of Economic Growth and Change (Development Economics II)<br/>         320. Macroeconomic Analysis I<br/>         322. Macroeconomic Analysis II<br/>         324, 325. Economics of the Law<br/>         326. Stochastic Macroeconomics<br/>         329. Federal Finance<br/>         330. Seminar in Public Finance<br/>         350. Modern Economic Thought<br/>         355. Seminar in Labor Economics<br/>         358. Seminar in Labor Market and Related Analysis<br/>         359. Economic Analysis of Legal Issues<br/>         365. Seminar in International Trade Theory and Policy<br/>         366. Seminar in International Monetary Theory<br/>         380. Graduate Economics Workshops<br/>         388. Industrial Organization<br/>         389. Seminar in Industrial and Governmental Problems<br/>         397, 398. Directed Research</p> |
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**Courses Currently Unscheduled**

235. The Economics of Crime, Law Enforcement, and Justice  
 303. Theory of Economic Decision Making  
 316. Seminar in Economics of Soviet-Type Socialism  
 321. Theory of Quantitative Economic Policy  
 323. Income Distribution Theory  
 331. Seminar in Economic History  
 345, 346. Demographic Techniques I and II  
 401. Seminar on the British Commonwealth  
 402. Interdisciplinary Seminar in the History of the Social Sciences

**Related Courses in Other Departments**

Courses in related fields may be selected from anthropology, business, computer science, forestry, history, mathematics, philosophy, political science, public policy studies, and sociology, or from an area that complements the candidate's area of research interests



in economics. See also the section on the Center for Demographic Studies under "Special Programs" in this bulletin.

## Education

Associate Professor Lucy T. Davis, Ed.D. (Columbia), *Chairman and Director of Graduate Studies*

### Professor

Ellis B. Page, Ed.D. (California at Los Angeles)

### Associate Professors

Robert H. Ballantyne, Ed.D. (Washington State); Peter F. Carbone, Ed.D. (Harvard); Joseph Di Bona, Ph.D. (California at Berkeley); Charles B. Johnson, Ed.D. (Duke); Robert N. Sawyer, Ed.D. (Wyoming)

### Professor Emeritus

W. Scott Gehman, Jr., Ph.D. (Pennsylvania State)

### Adjunct Associate Professor

Robert A. Pittillo, Jr., Ed.D. (Duke)

### Adjunct Assistant Professor

Mary E. Mayesky, Ph.D. (Wayne State)

### Lecturer

John A. Fowler, M.D. (Bowman Gray)

Qualified juniors, seniors, and graduate students may enroll in appropriate education courses as electives. Further information may be obtained from the Director of Graduate Studies.

## Courses of Instruction

205. Selected Topics

206. Selected Topics

215S. Seminar in Secondary School Teaching

216. Secondary Education: Internship

225. The Teaching of History and the Social Studies

232. Learning and Living in Families

236. Teaching Developmental and Remedial Reading  
in the Secondary School

242S. Group Interactions

246. Teaching of Mathematics

276. Teaching of High School Science

350. Directed Activities in Education

351. Directed Activities in Education

357. Directed Research

## Courses Currently Unscheduled

211. Education and the Mass Media

212S. Pedagogy and Political Economy: A World View

227. Contemporary Theories of Counseling and  
Psychotherapy

248. Practicum in Counseling

## Engineering

Professor Earl H. Dowell, Sc.D. (Massachusetts Inst. of Tech.), *Dean*

The School of Engineering offers programs of study and research leading to the M.S. and Ph.D. degrees with a major in biochemical, biomedical, civil and environmental, electrical, and mechanical engineering and materials science. These programs are designed to provide: (1) development of depth and breadth in mathematics, computer science, the basic physical sciences, the life sciences where appropriate, and the engineering sciences; (2) mastery of an advanced body of knowledge in the candidate's chosen field of specialization or research; (3) experience in the art of engineering, including strong elements of intuition, imagination, and judgment; and (4) performance of original research which, in the case of the M.S. degree, demonstrates the ability to advance knowledge in the area of professional study and, in the case of the Ph.D. degree, makes a significant contribution to the research literature through publication in a leading professional journal in the field. Engineering graduate students are expected to participate in advanced seminars appropriate to their fields of study.

A minimum of 30 units of earned graduate credit beyond the bachelor's degree is required for the M.S. degree: 12 in the major, 6 in related minor work (usually mathematics or natural science), 6 in either the major or minor subject or in other areas approved by the major department, and 6 for a research-based thesis. A nonthesis option requiring 30 units of course credit is available. Each degree program imposes additional requirements in the exercise of this option. There is no language requirement for this degree.

A minimum of 60 units of earned graduate credit beyond the bachelor's degree is required for the Ph.D. degree. In civil and environmental engineering, 12 units of course work beyond the master's degree are required to be in the major field, 6 in a related minor field, and 6 in either the major or minor field; in electrical engineering, 24 units are required in the major field and 12 units in a related minor field (often mathematics or natural science), 12 in either the major or minor subject or other areas approved by the major department, and 12 for a research-based dissertation. In biochemical, biomedical, and mechanical engineering and materials science there are no specific course requirements; each program is planned to meet individual needs. Doctoral students are required to pass qualifying and preliminary examinations that consist of either written, oral, or a combination of written and oral components, at the discretion of the committee and the department.

In addition, the School of Engineering and the Fuqua School of Business offer an MBA/MS Joint-Degree program. Further details about this program may be obtained from: Professor Eric I Pas, Director, MBA/MS Joint-Degree Program, Department of Civil and Environmental Engineering.

### **Courses of Instruction**

221. Computational Linear Algebra

222. Computer Solutions of Ordinary and Partial Differential Equations

## **Biochemical Engineering**

Professor Robert M. Hochmuth, Ph.D. (Brown), *Acting Director*

Associate Professor James D. Bryers, Ph.D. (Rice), *Director of Graduate Studies*

### **Professors**

Howard G. Clark, Ph.D. (Maryland); Charles H. Lochmüller, Ph.D. (Fordham)

### **Associate Professors**

Robert W. Henkens, Ph.D. (Yale); Alician V. Quinlan, Ph.D. (Massachusetts Inst. of Tech.)

### **Assistant Professors**

Robert S. Cherry, Ph.D. (Rice); David Needham, Ph.D. (Univ. of Nottingham); William M. Reichert, Ph.D. (Michigan); George A. Truskey, Ph.D. (Massachusetts Inst. of Tech.)

### **Research Associate Professors**

Andrew B. Balber, Ph.D. (Rockefeller Univ.)

The biochemical engineering program offers graduate education leading to the M.S. and Ph.D. degrees for those students interested in developing and using engineering principles to understand and implement biological and biochemical processes. Students follow a program of course work to reinforce knowledge of advanced principles of process engineering, transport phenomena, and kinetics, as well as microbiology, immunology, cell biology, chemistry, and biochemistry. Prior undergraduate courses in any or all of these areas would be useful to the applicant. Major emphasis in the program is on experimental research leading to either the M.S. or Ph.D. degrees. A nonthesis M.S. degree option is also available with prior approval.

Requirements for the Ph.D. degree include a total of 60 credit hours beyond the undergraduate degree with demonstrated performance in the key areas of bioprocess engineering, transport phenomena, thermodynamics or separations, biochemistry, and cellular biology or microbiology. In addition, to be considered a Ph.D. candidate, the student must successfully pass a qualifying examination no later than the fourth semester of residence. A preliminary examination by the candidate's thesis committee is also required prior to defending the research. A final oral defense of the research and written dissertation are also required by the Graduate School.

Requirements for the M.S. degree include a total of 30 credit hours beyond the undergraduate degree, a total of 24 course credits, an oral defense of the research project, and a written thesis.

### **Courses of Instruction**

205. Introductory Biochemical Engineering

206. Optimization of Bioprocess Kinetics

- 207. Transport Processes in Biological Systems
- 208. Introduction to Colloid and Surface Science
- 209. Kinetics and Reactor Design
- 210. Advanced Topics in Biochemical Engineering
- 216. Transport Processes in Cells and Organs

- 240. Biosensors
- 244. Applied Microbial Processes
- 260. Animal Cell Culture Technology
- 265. Special Topics

## Biomedical Engineering

Professor James H. McElhaney, Ph.D. (West Virginia), *Chairman*

Professor Olaf T. von Ramm, Ph.D. (Duke), *Director of Graduate Studies*

### Professors

Roger C. Barr, Ph.D. (Duke); Howard G. Clark, Ph.D. (Maryland); William E. Hammond, Ph.D. (Duke); Robert M. Hochmuth, Ph.D. (Brown); Loren W. Nolte, Ph.D. (Michigan); Theo C. Pilkington, Ph.D. (Duke); Robert Plonsey, Ph.D. (California at Berkeley); Myron L. Wolbarsht, Ph.D. (Johns Hopkins)

### Associate Professors

Donald S. Burdick, Ph.D. (Princeton); Ronald J. Jaszczak, Ph.D. (University of Florida); Ares Pasipoularides, M.D., Ph.D. (Minnesota)

### Assistant Professors

Frederick H. Daniels, Sc.D. (Columbia); Carey E. Floyd, Ph.D. (Duke); William N. Reichert, Ph.D. (Michigan); Peter K. Smith, M.D. (Duke); Gregg E. Trahey, Ph.D. (Duke); George A. Truskey, Ph.D. (Massachusetts Inst. of Tech.)

### Research Professor

Frederick L. Thurstone, Ph.D. (North Carolina State)

### Research Assistant Professors

Jack T. Cusma, Ph.D. (Wisconsin); James R. Jacobs, Ph.D. (University of Alabama, Birmingham)

Biomedical engineering is the discipline in which the physical, mathematical, and engineering sciences and associated technology are applied to biology and medicine. Contributions range from modeling and simulation of physiological systems through experimental research to solutions of practical clinical problems. The goal of the graduate program in biomedical engineering is to combine training in advanced engineering, biomedical engineering, and the life sciences so that graduates of the program can contribute at the most advanced professional level. The doctoral dissertation should demonstrate significant and original contributions to an interdisciplinary topic, accomplished as an independent investigator. The major, current, research areas are: biochemical engineering, biomechanics, biomedical materials, biomedical modeling, biosensors, data acquisition and processing, medical imaging, and electrophysiology. Every biomedical engineering graduate student is required to serve as a teaching assistant as part of the graduate training.

### Courses of Instruction

- 201. Electrophysiology
- 202. Biomedical Transfer Processes
- 205, 206. Microprocessors and Digital Instruments
- 207. Transport Phenomena in Biological Systems
- 211. Theoretical Electrophysiology
- 212. Theoretical Electrocardiography
- 215. Biomedical Materials and Artificial Organs
- 216. Transport Phenomena in Cells and Organs
- 222. Principles of Ultrasound Imaging
- 230. Biomechanics
- 233. Modern Diagnostic Imaging Systems
- 235. Acoustics and Hearing

- 241. Artificial Intelligence in Medicine
- 243. Computers in Biomedical Engineering
- 244. Mathematical Models of Physiological Systems
- 265. Advanced Topics in Biomedical Engineering
- 333. Biomedical Imaging
- 399. Special Readings in Biomedical Engineering

### Courses Currently Unscheduled

- 204. Measurement and Control of Cardiac Electrical Events
- 221. Electrophysiological Techniques
- 311. Inverse Models

## Civil and Environmental Engineering

Professor P. Aarne Vesilind, Ph.D. (North Carolina at Chapel Hill), *Chairman*

Professor J. Jeffrey Peirce, Ph.D. (University of Wisconsin at Madison), *Director of Graduate Studies*

### Professors

Peter K. Haff, Ph.D. (University of Virginia); Robert J. Melosh, Ph.D. (Washington); Henry J. Petroski, Ph.D.



(University of Illinois-Urbana); Senol Utku, Sc.D. (Massachusetts Institute of Technology); James F. Wilson, Ph.D. (Ohio State)

**Associate Professors**

Mrinmay Biswas, Ph.D. (Virginia); James D. Bryers, Ph.D. (Rice); Tomasz A. Hueckel, Ph.D. (Polish Academy of Science), D.Sc. (National Polytechnic Inst.); Miguel A. Medina, Jr., Ph.D. (Florida); Eric I. Pas, Ph.D. (Northwestern); Kenneth H. Reckhow, Ph.D. (Harvard)

**Assistant Professors**

Bruce C. Faust, Ph.D. (Calif. Inst. of Tech.); Timothy L. Jacobs, Ph.D. (Purdue)

Civil and environmental engineering is the broadest of the engineering disciplines, extending across mathematics, the natural sciences including physics, biology, and chemistry, and emphasizing the social and management sciences and humanities. Graduate students at Duke conduct research for a Ph.D. or an M.S. degree in one of seven specialty areas: environmental engineering, mechanics of solids and fluids, structural engineering, ocean engineering, urban and regional planning and transportation, water resources, and geotechnical engineering. A wide range of programs complements these major research efforts: public policy, economics, sociology, and management sciences. Additionally, a student may elect courses to support the research offered by the School of Public Health at the University of North Carolina.

**Courses of Instruction**

- 201. Advanced Mechanics of Solids
- 203. Plasticity
- 204. Plates and Shells
- 205. Elasticity
- 207. Transport Phenomena in Biological Systems
- 210. Intermediate Dynamics
- 212. Mechanical Behavior and Fracture of Materials
- 215. Engineering Systems Analysis
- 216. Transportation Planning and Policy Analysis
- 217. Transportation Systems Analysis
- 218. Engineering Management and Project Evaluation
- 225. Dynamic Engineering Hydrology
- 227. Groundwater Hydrology and Contaminant Transport
- 233. Prestressed Concrete Design
- 235. Foundation Engineering
- 236. Earth Structures
- 237. Advanced Soil Mechanics
- 240. Fate of Organic Chemicals in the Environment
- 242. Environmental Chemistry
- 243. Physicochemical Unit Operations in Water Treatment
- 244. Applied Microbial Processes
- 245. Pollutant Transport Systems
- 246. Water Supply Design
- 248. Solid Waste and Resource Recovery Engineering
- 249. Control of Hazardous and Toxic Waste Engineering

- 251. Systematic Engineering Analysis
- 254. Applications of Finite Element Analysis
- 257. Structural Optimization
- 258. Analysis of Dynamic and Nonlinear Behavior of Structures
- 265. Advanced Topics in Civil and Environmental Engineering
- 281. Experimental Systems
- 283. Structural Dynamics
- 301, 302. Fall and Spring Seminars
- 399. Special Readings in Civil and Environmental Engineering

**Courses Currently Unscheduled**

- 202. Advanced Mechanics of Solids II
- 221. Incompressible Fluid Flow
- 222. Open Channel Flow
- 223. Flow Through Porous Media
- 226. Operational Hydrology
- 231. Structural Engineering Analysis
- 232. Reinforced Concrete Design
- 234. Advanced Structural Design in Metals
- 238. Rock Mechanics
- 239. Physical Properties of Soils
- 247. Air Pollution Control
- 337. Elements of Soil Dynamics
- 350. Advanced Engineering Analysis

**Electrical Engineering**

Professor H. Craig Casey, Jr., Ph.D. (Stanford), *Chairman*

Professor Peter N. Marinos, Ph.D. (North Carolina State), *Director of Graduate Studies*

**Professors**

Richard B. Fair, Ph.D. (Duke); William T. Joines, Ph.D. (Duke); Robert B. Kerr, Ph.D. (Johns Hopkins); Loren W. Nolte, Ph.D. (Michigan); Theo C. Pilkington, Ph.D. (Duke); Kishor S. Trivedi, Ph.D. (Illinois); Paul P. Wang, Ph.D. (Ohio State); Thomas G. Wilson, Sc.D. (Harvard)

**Associate Professors**

Joanne Bechta Dugan, Ph.D. (Duke); Herbert Hacker, Ph.D. (Michigan); Gershon Kedem, Ph.D. (Wisconsin); Hisham Z. Massoud, Ph.D. (Stanford)

**Assistant Professors**

Dimitri Alexandrou, Ph.D. (California-San Diego); John A. Board, Jr., Ph.D. (Oxford); Apostolos Dollas, Ph.D. (Illinois); Rhett T. George, Jr., Ph.D. (Florida); John H. L. Hansen, Ph.D. (Georgia Tech.); Ronald C. Wong, Ph.D. (Duke)

**Research Assistant Professor**

Karen Z. Frenzel, Ph.D. (Duke)

**Professor Emeritus**

Harry A. Owen, Jr., Ph.D. (North Carolina State)

A student may specialize in any one of the following fields in working toward either the M.S. or the Ph.D. degree with a major in electrical engineering: computer-aided design, computer engineering, detection and estimation theory, digital signal processing, electromagnetic fields and microwaves, integrated circuit design and fabrication, microprocessor systems, robotics and control systems, solid-state devices and materials, solid-state power conditioning, and VLSI circuit design.

Recommended prerequisites for the graduate courses in electrical engineering include a knowledge of basic mathematics and physics, electric networks, and system theory. Students in doubt about their background for enrollment in specific courses should discuss the matter with the Director of Graduate Studies. The M.S. degree program includes either a thesis or a project and an oral examination. A qualifying examination is required for the Ph.D. degree program. This examination is intended to test both the breadth and depth of the student's understanding of basic electrical engineering concepts. There is no foreign language requirement.

**Courses of Instruction**

- 201. Digital Processing of Speech Signals
- 202. Digital Communication Systems
- 203. Random Signals and Noise
- 204. Computer Network Architecture
- 205. Signal Detection and Extraction Theory
- 206. Digital Signal Processing
- 207. Fault-Tolerant and Testable Computer Systems
- 208. Digital Computer Architecture and Design
- 209. Microprocessor Fundamentals and Applications
- 210. Introduction to VLSI Design
- 211. Quantum Mechanics
- 213. Modern Optics
- 214. Introduction to Solid-State Physics
- 216. Devices for Integrated Circuits
- 218. Integrated Circuit Engineering
- 219. Digital Integrated Circuits
- 225. Microwave Electronic Circuits
- 227. Network Synthesis
- 234. Power Electronics: High-Power Circuits
- 235. Nonlinear Magnetic and Semiconductor Power Converters
- 236. Energy-Storage Power Converters
- 241. Linear Systems
- 243. Advanced Linear Systems
- 250. Introduction to Robotics
- 251. Pattern Classification and Recognition
- 252. Computer Systems Organization

- 265. Advanced Topics in Electrical Engineering
- 271. Electromagnetic Theory
- 272. Electromagnetic Communication Systems
- 273. Optical Communication Systems
- 308. Advanced Topics in Digital Systems
- 310. CMOS VLSI Design
- 316. Advanced Physics of Semiconductor Devices
- 320. Integrated Circuit Fabrication Laboratory
- 333. Electronic Properties of Submicron Solid-State Devices
- 399. Special Readings in Electrical Engineering

**Courses Currently Unscheduled**

- 215. Semiconductor Physics
- 217. Lasers
- 222. Nonlinear Analysis
- 224. Advanced Electronic Circuits
- 226. Modeling/Computer-Aided Analysis of Electronic Systems
- 302. Applied Information Theory and Statistical Estimation
- 305. Advanced Topics in Signal Processing
- 317. Quantum Electronics
- 324. Nonlinear Oscillations in Physical Systems
- 342. Optimal Control Theory
- 371. Advanced Electromagnetic Theory
- 373. Selected Topics in Field Theory

**Mechanical Engineering and Materials Science**

Professor Robert M. Hochmuth, Ph.D. (Brown), *Chairman*

Professor Charles M. Harman, Ph.D. (Wisconsin), *Director of Graduate Studies*

**Professors**

Adrian Bejan, Ph.D. (Massachusetts Inst. of Tech.); Jack B. Chaddock, Sc.D. (Massachusetts Inst. of Tech.); Franklin H. Cocks, Sc.D. (Massachusetts Inst. of Tech.); Earl H. Dowell, Sc.D. (Massachusetts Inst. of Tech.); Devendra P. Garg, Ph.D. (New York Univ.); Ulrich M. Gösele, Ph.D. (Max Planck Institut für Metallforschung, Stuttgart); George W. Pearsall, Sc.D. (Massachusetts Inst. of Tech.); Edward J. Shaughnessy, Jr., Ph.D. (Virginia); Marion L. Shepard, Ph.D. (Iowa State); Teh Yu Tan, Ph.D. (California at Berkeley)

**Associate Professors**

Donald B. Bliss, Ph.D. (Massachusetts Inst. of Tech.); Phillip L. Jones, Ph.D. (California at Los Angeles); Alician V. Quinlan, Ph.D. (Massachusetts Inst. of Tech.); Donald Wright, Ph.D. (Purdue)

### Assistant Professors

Gale H. Buzzard, Ph.D. (North Carolina State); Robert S. Cherry, Ph.D. (Rice University); John G. Georgiadis, Ph.D. (University of California at Los Angeles); Josiah Doss Knight, Ph.D. (University of Virginia); David Needham, Ph.D. (University of Nottingham)

### Research Assistant Professor

Roger Tran-Son-Tay, D.Sc. (Washington University)

The department offers programs of study and research leading to the M.S. and Ph.D. degrees in both Mechanical Engineering and Materials Science. Within mechanical engineering, the broad areas of concentration include thermal and fluids systems, mechanics and biomechanics, and dynamics and control. Within materials science, the areas of concentration include electronic materials, biomaterials, and the determination of material characteristics. The department emphasizes a highly research-oriented Ph.D. degree program.

Current research areas available include: cellular biomechanics; biorheology; convection; diffusion and heat transfer in heterogeneous media; aeroelasticity; computational fluid dynamics; chaotic systems; vibrations and acoustics of dynamic systems; sound propagation and absorbing materials; thermal performance of buildings; thermal design by entropy generation; control systems; robotics; expert systems; bearing design and lubrication; mechanical properties of human tissues; positron annihilation spectroscopy; diffusion and kinetics in Si GaAs and other electronic materials; modeling and optimization of bioprocesses; and cell culture optimization.

### Courses of Instruction

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| 202. Engineering Thermodynamics                  | 228. Lubrication                                     |
| 205. Biochemical Engineering                     | 229. Computational Fluid Mechanics and Heat Transfer |
| 206. Optimization of Bioprocess Kinetics         | 230. Modern Control and Dynamic Systems              |
| 207. Transport Phenomena in Biological Systems   | 236. Engineering Acoustics and Noise Control         |
| 208. Introduction to Colloid and Surface Science | 237. Aerodynamics                                    |
| 210. Intermediate Dynamics                       | 240. Patent Technology and Law for Engineers         |
| 211. Theoretical and Applied Polymer Science     | 245. Applications in Expert Systems                  |
| 212. Electronic Materials                        | 265. Advanced Topics in Mechanical Engineering       |
| 214. Corrosion and Corrosion Control             | 270. Robot Control and Automation                    |
| 215. Biomedical Materials and Artificial Organs  | 277. Optimization Methods for Mechanical Design      |
| 216. Materials Science and Solar Technology      | 280. Convective Heat Transfer                        |
| 217. Fracture of Engineering Materials           | 281. Conduction and Radiation Heat Transfer          |
| 218. Thermodynamics of Electronic Materials      | 325. Aeroelasticity                                  |
| 221. Compressible Fluid Flow                     | 331. Nonlinear Control Systems                       |
| 224. An Introduction to Turbulence               | 399. Special Readings in Mechanical Engineering      |
| 225. Mechanics of Viscous Fluids                 |  |
| 226. Intermediate Fluid Mechanics                |  |
| 227. Advanced Fluid Mechanics                    |  |

### Courses Currently Unscheduled

322. Mechanics of Viscous Fluids

## English

Professor Stanley Fish, Ph.D. (Yale), *Chairman*

Professor Marianna Torgovnick, Ph.D. (Columbia), *Assistant Chairman*

Professor Oliver W. Ferguson, Ph.D. (Illinois), *Director of Graduate Studies*

Assistant Professor Michael V. Moses, Ph.D. (Virginia), *Assistant Director of Graduate Studies*

### Professors

Carl Anderson, Ph.D. (Pennsylvania); James Applewhite, Ph.D. (Duke); Louis J. Budd, Ph.D. (Wisconsin), *James B. Duke Professor of English*; Cathy N. Davidson, Ph.D. (SUNY-Binghamton); A. Leigh DeNeef, Ph.D. (Pennsylvania State); Robert F. Gleckner, Ph.D. (Johns Hopkins); Wallace Jackson, Ph.D. (Pennsylvania); Frank Lentricchia, Ph.D. (Duke); Holger O. V. Nygard, Ph.D. (California at Berkeley); Annabel Patterson, Ph.D. (London); Lee Patterson, Ph.D. (Yale); Reynolds Price, B. Litt. (Oxford); Dale B. J. Randall, Ph.D. (Pennsylvania); Clyde de Loache Ryals, Ph.D. (Pennsylvania); Eve Sedgwick, Ph.D. (Yale); Barbara Herrnstein Smith (Brandeis); Grover C. Smith, Ph.D. (Columbia); Victor H. Strandberg, Ph.D. (Brown); Jane Tompkins, Ph.D. (Yale); George W. Williams, Ph.D. (Virginia); Kenny J. Williams, Ph.D. (Pennsylvania)

### Associate Professors

Ronald R. Butters, Ph.D. (Iowa); John Clum, Ph.D. (Princeton); Gerald E. Gerber, Ph.D. (Northwestern); George D. Gopen, Ph.D. (Harvard); Buford Jones, Ph.D. (Harvard); Elgin W. Mellown, Ph.D. (London); Deborah Pope, Ph.D. (Wisconsin); Joseph Porter, Ph.D. (California at Berkeley); Regina M. Schwartz, Ph.D. (Virginia)



#### Assistant Professors

Sarah Beckwith, Ph.D. (London); Thomas Ferraro, Ph.D. (Yale); Jane Gaines, Ph.D. (Northwestern); Michael Moon, Ph.D. (Johns Hopkins); Susan Willis, Ph.D. (California at San Diego)

#### Adjunct Assistant Professor

Julie Tetel, Ph.D. (University of North Carolina at Chapel Hill)

The department offers graduate work leading to the A.M. and Ph.D. degrees although normally students seeking only the A.M. degree are not admitted. If not already earned elsewhere, the A.M. degree may be taken en route to the Ph.D. and by students who elect to withdraw from the doctoral program. The A.M. degree is not required for students pursuing the Ph.D. A statement of the requirements for the A.M. and Ph.D. degrees may be obtained from the Director of Graduate Studies. The department requires a reading knowledge of at least one foreign language for the Ph.D. degree; an additional language or languages may be required by the student's committee.

#### Courses of Instruction

- |   |   |
|---|---|
| 200. ESL Composition  | 324. Studies in Shakespeare   |
| 205. Semiotics and Linguistics                                      | 329. Studies in Milton  |
| 207. Old English Language and Literature                            | 337. Studies in Augustanism   |
| 208. History of the English Language                                | 338. Studies in a Major Augustan Author                                 |
| 209. Present-Day English  | 341. Studies in Romanticism   |
| 212. Middle English Literature: 1100 to 1500                        | 347. Studies in Victorianism  |
| 221. Renaissance Prose and Poetry: 1500 to 1660                     | 348. Studies in a Major Nineteenth-Century Author                       |
| 225. Renaissance Drama: 1500 to 1642                                | 353. Studies in Modern British Literature                               |
| 235. Restoration and Eighteenth-Century Literature:<br>1660 to 1800 | 361. Studies in American Literature before 1915                         |
| 241. Romantic Literature: 1790 to 1830                              | 368. Studies in a Major American Author before 1915                     |
| 245. Victorian Literature: 1830 to 1900                             | 375. Studies in Modern American Literature                              |
| 251. British Literature since 1900                                  | 376. Studies in a Modern Author (British or American)                   |
| 263. American Literature to 1865                                    | 381. Special Topics Seminar   |
| 267. American Literature: 1865 to 1915                              | 385. Studies in Literary Criticism                                      |
| 269. American Women Writers   | 386. Problems in the Theory of Value and Judgment                       |
| 275. American Literature since 1915                                 | 388. The History of Rhetoric: Classical to Renaissance                  |
| 281. Studies in Genre   | 389. The History of Rhetoric: Eighteenth to Twentieth<br>Centuries      |
| 283. Feminist Theory and the Humanities                             | 390. Composition Theory and Pedagogy                                    |
| 285. Major Texts in the History of Literary Criticism               | 391. Tutorial in Special Topics   |
| 288. Special Topics   | 392. Tutorial in Journal Editing  |
| 289. The Theory of the Novel  | 393. Professionalism, Theory and Power in Legal and<br>Literary Studies |
| 310. Studies in Old English Literature                              |   |
| 312. Studies in Middle English Literature                           |   |
| 315. Studies in Chaucer   |   |
| 321. Studies in Renaissance Literature                              |   |

#### Courses Currently Unscheduled

383. Studies in Textual Criticism

#### Tutorials

Specialized subjects of study may be offered, numbered in the 390s, to accommodate the interests of advanced graduate students. Tutorials may be offered to single students or to small groups. Instruction will be conducted in weekly sessions, or in more frequently scheduled sessions, if the instructor wishes. Emphasis will be on independent reading and investigation, and oral and written reports. A substantial amount of writing will be required.

Students are advised to consult the Director of Graduate Studies about the availability of tutorials.

## Forestry and Environmental Studies

Professor George F. Dutrow, Ph.D. (Duke), *Dean*

Professor William J. Stambaugh, Ph.D. (Yale), *Director of Graduate Studies*

#### Professors

Kenneth R. Knoerr, Ph.D. (Yale); Curtis J. Richardson, Ph.D. (Tennessee)

#### Associate Professors

Norman L. Christensen, Jr., Ph.D. (California at Santa Barbara); Randall A. Kramer, Ph.D. (California at Davis); Kenneth H. Reckow, Ph.D. (Harvard); Daniel D. Richter, Ph.D. (Duke)

### Assistant Professors

Bruce C. Faust, Ph.D. (Calif. Inst. of Tech.); Richard T. Di Giulio, Ph.D. (Virginia Polytechnic Inst.); Lynn A. Maguire, Ph.D. (Utah State); Ram Oren, Ph.D. (Oregon State); Peter J. Parks, Ph.D. (California at Berkeley)

### Professors Emeriti

Roger F. Anderson, Ph.D. (Minnesota); Henry Hellmers, Ph.D. (California at Berkeley); Jane Philpott, Ph.D. (Iowa); James G. Yoho, Ph.D. (Michigan State)

### Adjunct Professors

Stephen G. Boyce, Ph.D. (North Carolina State); William K. Condrell, J.D. (Harvard); Michael P. Dieter, Ph.D. (University of Mississippi); William F. Hyde, Ph.D. (Michigan); William Sizemore, Ph.D. (University of Georgia); Harold K. Steen, Ph.D. (University of Washington)

### Adjunct Associate Professor

Robert G. Healy, Ph.D. (California at Los Angeles)

### Adjunct Assistant Professor

Ralph Joseph Alig, Ph.D. (Oregon State)

Major and minor work is offered in the areas of natural resource science/ecology, natural resource systems science, and natural resource economics/policy. Programs of study and research lead to the A.M., M.S., and Ph.D. degrees. College graduates who have a bachelor's degree in one of the natural or social sciences, forestry, engineering, business, or environmental science will be considered for admission to a degree program. Students will be restricted to the particular fields of specialization for which they are qualified academically. Graduate School programs usually concentrate on some area of natural resource science/ecology, systems science, or economics/policy, while study in resource management is more commonly followed in one of the professional master's degree programs of the School of Forestry and Environmental Studies. For more complete program descriptions and information on professional training in forestry or environmental studies, the *Bulletin of Duke University: School of Forestry and Environmental Studies* should be consulted.

The specific degrees available in forestry and related natural resources through the Graduate School are: the A.M. (with or without a thesis), M.S. (with a thesis), and the Ph.D. Students majoring in forestry or environmental studies may be required to demonstrate satisfactory knowledge of one or two foreign languages for the Ph.D. degree.

### Courses of Instruction

- |  |  |
|--|--|
| 200. Student Projects                          | 299. Independent Projects                                      |
| 201. Field Studies                             | 301. Forest Nutrition Management                               |
| 204. Forest Inventory, Growth, and Yield       | 302. Models in Forestry  |
| 205. Silviculture                              | 305. Harvesting Effects on Productivity                        |
| 207. Forest Pest Management                    | 306. Dynamic Modeling of Forest Management Strategies          |
| 208. Fire Behavior and Use                     | 307. Ecophysiology of Productivity and Stress                  |
| 210L. Forest Pathology                         | 312. Wetlands Ecology  |
| 211L. Applied Ecology and Ecosystem Management | 313. Advanced Topics in Ecotoxicology                          |
| 212. Ecological Toxicology                     | 316. Case Studies in Environmental Management                  |
| 213. Forest Ecosystems                         | 322. Microbiology of Forest Soils                              |
| 215. Environmental Physiology                  | 330L. Environmental Monitoring and Instrumentation             |
| 216. Applied Population Ecology                | 331. Water Resource Systems                                    |
| 218. Barrier Island Ecology                    | 332. Air Quality Management                                    |
| 221L. Soil Resources                           | 335. Water Quality Modeling                                    |
| 230. Weather and Climate                       | 350. Applied Regression Analysis                               |
| 231. Environmental Climatology                 | 355. Optimization Methods for Resource Management              |
| 232. Microclimatology                          | 357. Systems Ecology and Modeling                              |
| 234. Watershed Hydrology                       | 361. Forest Resource Management                                |
| 236. Water Quality Management                  | 366. Mathematical Modeling of Lake and Reservoir Water Quality |
| 237. Watershed Modeling                        | 367. Seminar in Forest Resource Management                     |
| 242. Environmental Chemistry                   | 372, 373. Advanced Natural Resource Economics                  |
| 261. Remote Sensing for Resource Management    | 381. Natural Resource Policy                                   |
| 262. Forest Utilization                        | 382. International Environmental Problems                      |
| 266. Ecology of Southern Appalachian Forests   | 385. Decision Theory and Risk Analysis                         |
| 267. Wildland and Wildlife Management          | 388. Seminar in Resource and Environmental Policy              |
| 270. Resource Economics and Policy             | 389. Seminar in Forest and Conservation History                |
| 283. Environmental Policy and Values           |  |
| 285. Land Use Principles and Policies          |  |

## Courses Currently Unscheduled

- 209. Forest Entomology
- 212. Ecosystem Dynamics in Forest Productivity
- 252. Computer Applications in Forestry
- 304. Forest Yield
- 308. Tree Biology
- 309. Forest Regeneration
- 310. Forest Productivity and Mineral Cycling
- 314. Integrated Case Studies in Toxicology
- 315. Effects of Pollutants on Ecosystems
- 317. Applied Ecological Problem Solving
- 318. Seminar in Ecotoxicology
- 319. Seminar in Natural Resource Ecology
- 320. Seminar in Integrated Case Studies in Natural Resource Analysis
- 325. Ecologic Effects of Acid Deposition
- 338. Micrometeorology and Biometeorology Seminar
- 384. Special Tax Problems for Industrial Timberland Owners

## The University Program in Genetics

Professor Paul Modrich, Ph.D. (Stanford), *Director*

### Professors

Deepak Bastia, Ph.D. (Chicago); John E. Boynton, Ph.D. (California at Davis); Sheila Counce, Ph.D. (Univ. of Edinburgh); Nicholas Gillham, Ph.D. (Harvard); Samson R. Gross, Ph.D. (Columbia); Wolfgang Karl Joklik, D.Phil. (Univ. of Oxford), *James B. Duke Professor of Microbiology and Immunology*; Nicholas M. Kredich, M.D. (Michigan); Montrose J. Moses, Ph.D. (Columbia); Joseph Nevins, Ph.D. (Duke); R. Bruce Nicklas, Ph.D. (Columbia); Calvin L. Ward, Ph.D. (Texas); Frances Ellen Ward, Ph.D. (Brown); Robert E. Webster, Ph.D. (Duke)

### Associate Professors

Sharyn Endow, Ph.D. (Yale); Ronald C. Greene, Ph.D. (California Inst. of Tech.); Arno L. Greenleaf, Ph.D. (Harvard); Edward W. Holmes, M.D. (Pennsylvania); Tao-shih Hsieh, Ph.D. (California at Berkeley); Jack D. Keene, Ph.D. (Washington at Seattle); Cathy C. Laurie, Ph.D. (Minnesota); Elwood A. Linney, Ph.D. (California at San Diego); Mark D. Rausher, Ph.D. (Cornell); Frederick H. Schachat, Ph.D. (Stanford); Deborah A. Steege, Ph.D. (Yale); Judith L. Swain, M.D. (California at San Diego); Marcy K. Uyenoyama, Ph.D. (Stanford)

### Assistant Professors

Michael D. Been, Ph.D. (Washington at Seattle); Mary Vickers Burdett, Ph.D. (Georgetown); Michael S. Hersfield, M.D. (Pennsylvania); Stephen A. Johnston, Ph.D. (Wisconsin); Russel E. Kaufman, M.D. (Ohio State University); Bruce D. Kohorn, Ph.D. (Yale); Kenneth N. Kreuzer, Ph.D. (University of Chicago); Michael C. Ostrowski, Ph.D. (South Carolina at Columbia)

### Adjunct Professors

John W. Drake, Ph.D. (California Inst. of Tech.); Burke H. Judd, Ph.D. (California Inst. of Tech.); Thomas Kunkel, Ph.D., (Cincinnati); John Charles Lucchesi, Ph.D. (California at Berkeley); Michael A. Resnick, Ph.D. (University of California at Berkeley); Akio Sugino, Ph.D. (Nagoya University, Japan)

The University Program in Genetics provides a course of study in those facets of biology related to genetics. Graduate students registered in any of the biological sciences departments may apply to the faculty of the genetics program to pursue study and research leading to an advanced degree. It would be helpful if applicants for admission to the Graduate School indicated their interest in the genetics program at the time of application. Requests for information describing the research interests of the staff, facilities, and special stipends and fellowships should be addressed to the Director, Genetics Program (Department of Biochemistry).

## Courses of Instruction

- 205. Molecular Biology
- 215. Molecular Genetics I: Genetic Mechanisms
- 268. Molecular Biology II: Nucleic Acids
- 280. Principles of Genetics
- 281S. DNA, Chromosomes, and Evolution
- 283. Extrachromosomal Inheritance
- 285S. Ecological Genetics
- 286. Evolutionary Mechanisms
- 288. Mathematical Population Genetics

## Geology

Professor Ronald D. Perkins, Ph.D. (Indiana), *Chairman*

Professor S. Duncan Heron, Jr., Ph.D. (North Carolina at Chapel Hill), *Director of Graduate Studies*

### Professors

Orrin H. Pilkey, Ph.D. (Florida State), *James B. Duke Professor of Geology*; Bruce R. Rosendahl, Ph.D. (California at San Diego)



#### Associate Professors

Paul A. Baker, Ph.D. (California at San Diego); Bruce Hayward Corliss, Ph.D. (Univ. of Rhode Island); Thomas C. Johnson, Ph.D. (California at San Diego); Jeffrey A. Karson, Ph.D. (SUNY)

#### Assistant Professors

Alan Boudreau, Ph.D. (University of Washington); Emily M. Kline, Ph.D. (Columbia); Richard A. Strelitz, Ph.D. (Princeton)

The Department of Geology offers graduate work leading to the M.S. and Ph.D. degrees. An undergraduate degree in geology is not a prerequisite for graduate studies, but a student must have had or must take a summer field geology course (or equivalent experience), mineralogy, igneous and metamorphic rocks, stratigraphy or sedimentation, and structural geology. In addition, the student must have had or must take one year of college chemistry, one year of college physics, and mathematics through calculus.

Graduate courses in the Department of Geology provide specialized training in the fields of facies analysis, sedimentary petrology, geological oceanography and limnology, coastal geology, micropaleontology, paleoceanography, geophysics, low-temperature geochemistry; igneous petrology, high-temperature geochemistry, and structural geology and tectonics.

An acceptable thesis is required. There is no language requirement for the M.S. degree.

#### Courses of Instruction

- |  |  |
|--|--|
| 200. Beach and Coastal Processes                         | 251. Physics of the Earth                  |
| 203. Physical Oceanography                               | 252. Exploration Seismology                |
| 206S. Principles of Geological Oceanography              | 255. Seismic Interpretation                |
| 208S. Paleoceanography                                   | 260S. Hydrocarbon Exploration              |
| 209. Marine Sediments                                    | 269. Theoretical Geochemistry              |
| 212. Carbonate Facies Analysis: Recent and Ancient       | 270. Sedimentary Geochemistry              |
| 214S. Sedimentary Petrography                            | 271. Isotope Geochemistry                  |
| 215. Clastics Facies Analysis: Recent and Ancient        | 272. Biogeochemistry                       |
| 216. Field Analysis of South Florida Carbonates          | 281S. Advanced Topics In Igneous Petrology |
| 217. Field Analysis of Ancient Sedimentary Sequences     | 283S. Experimental Methods in Geology      |
| 219. Sediment Transport                                  | 292. Computer Methods in Geology           |
| 230. Advanced Structural Geology                         | 295S. Advanced Topics in Geology           |
| 233. Oceanic Crust and Ophiolites                        | 371, 372. Advanced Topics in Geology       |
| 236. Lithosphere Plate Boundaries                        |  |
| 237. Structure and Evolution of the Appalachian Orogen   | <b>Courses Currently Unscheduled</b>       |
| 239. Advanced Topics in Structural Geology and Tectonics | 204. Chemical Oceanography                 |
| 249. Marine Micropaleontology                            | 253S. Geophysics                           |
|  | 275. Economic Geology                      |

## Germanic Languages and Literature

Associate Professor Frank Borchardt, Ph.D. (Johns Hopkins), *Chairman*  
Professor James L. Rolleston, Ph.D. (Yale), *Director of Graduate Studies*

#### Associate Professor

A. Tilo Alt, Ph.D. (Texas)

#### Assistant Professors

Michael M. Morton, Ph.D. (Virginia); Ann Marie Rasmussen, Ph.D. (Yale)

#### Professor Emeritus

Leland R. Phelps, Ph.D. (Ohio State)

The Department of Germanic Languages and Literature offers graduate work leading to the A.M. degree. Students who expect to major in German should have had sufficient undergraduate courses in Germanic languages to enable them to proceed to more advanced work.

Students who wish to take courses in German as a related field should normally have completed a third-year course (in exceptional cases, a second year) of college German with acceptable grades.

## Courses of Instruction

200S. Proseminar  
201S, 202S. Goethe  
205, 206. Middle High German  
207S. German Romanticism  
209S. Drama  
210S. The Eighteenth Century  
211S. Nineteenth-Century Literature  
214S. The Twentieth Century  
215S. Seventeenth-Century Literature

216. History of the German Language  
217S. Renaissance and Reformation Literature  
218S. The Teaching of German  
219. Applied Linguistics  
230S. Lyric Poetry

## Courses Currently Unscheduled

321, 322. Germanic Seminar

## Health Administration

Professor J. Alexander McMahon, J.D. (Harvard), *Chairman*

Associate Professor Robert Taylor, Ph.D. (North Carolina at Chapel Hill), *Director of Graduate Studies*

### Professors

B. Jon Jaeger, Ph.D. (Duke); David G. Warren, J.D. (Duke)

### Associate Professors

David J. Falcone, Ph.D. (Duke); Aleda V. Roth, Ph.D. (Ohio State)

### Consultant

Robert E. Toomey, LL.D. (Clemson)

### Adjunct Associate Professor

Robert G. Winfree, M.A. (Iowa)

### Adjunct Assistant Professors

William J. Donelan, M.S. (Duke); John Kevin Moore, J.D. (University of Minnesota); Duncan Yaggy, Ph.D. (Brandeis)

The Department of Health Administration offers graduate work leading to the M.H.A. degree. The graduate program is offered through two academic years (including a summer administrative internship) and leads principally toward a career in the corporate management of hospitals and other health care delivery organizations. Students without previous administrative experience in the health field are encouraged to apply for a twelve-month administrative fellowship following graduation. Admission to the program is based upon the capability for graduate study and demonstrated leadership potential of the candidate.

## Courses of Instruction

301. Health System and the Environment  
302. Organizational Behavior in Health Systems  
303, 304. Health Systems and the Environment—  
Laboratory  
311, 312. Leadership Seminar  
321, 322. Strategic Management  
325. Health Law for Management  
327. Financial Management for Health Care  
Organizations  
331. Human Resources Management  
341, 342. Advanced Seminar in Health Care  
Institutional Management

343. Comparative Health Systems  
352. Health Services for the Aged  
354. Quality Assurance, Risk Management, and  
Liability Insurance  
356. Health Policy Analysis  
357. Current Health Issues  
358. Cost Benefit Analysis  
362. Planning and Managing Alternative Delivery  
Systems  
371, 372. Directed Research

## History

Professor Warren Lerner, Ph.D. (Columbia), *Chairman*

Associate Professor Peter H. Wood, Ph.D. (Harvard), *Director of Graduate Studies*

### Professors

Clark R. Cahow, Ph.D. (Duke); John Cell, Ph.D. (Duke); William Chafe, Ph.D. (Columbia); Calvin D. Davis, Ph.D. (Indiana); Robert F. Durden, Ph.D. (Princeton); David Barry Gaspar, Ph.D. (Johns Hopkins); Bruce R. Kuniholm, Ph.D. (Duke); Seymour Mauskopf, Ph.D. (Princeton); Martin Miller, Ph.D. (Chicago); John F. Oates, Ph.D. (Yale); John F. Richards, Ph.D. (California at Berkeley); Alex Roland, Ph.D. (Duke); Anne Firor Scott, Ph.D. (Radcliffe); William E. Scott, Ph.D. (Yale); John J. TePaske, Ph.D. (Duke); Ronald Witt, Ph.D. (Harvard); Charles R. Young, Ph.D. (Cornell)

### Associate Professors

Arif Dirlik, Ph.D. (Rochester); Peter C. English, M.D., Ph.D. (Duke); Raymond Gavins, Ph.D. (Virginia); Lawrence C. Goodwyn, Ph.D. (Texas); Andrew Gordon, Ph.D. (Harvard); Cynthia B. Herrup, Ph.D. (Northwestern); Alexander Keyssar, Ph.D. (Harvard); Claudia Koonz, Ph.D. (Rutgers); Sydney Nathans, Ph.D. (Johns Hopkins); Kristen B. Neuschel, Ph.D. (Brown University); William M. Reddy, Ph.D. (Chicago); Peter H. Wood, Ph.D. (Harvard)

### Assistant Professors

Janet J. Ewald, Ph.D. (Wisconsin); Monica Green, Ph.D. (Princeton); Thomas Robisheaux, Ph.D. (Virginia); Julius S. Scott, Ph.D. (Duke)

### Professors Emeriti

Arthur Ferguson, Ph.D. (Cornell); Joel G. Colton, Ph.D. (Columbia); John Hope Franklin, Ph.D. (Harvard), *James B. Duke Professor Emeritus of History*; Irving B. Holley, Jr., Ph.D. (Yale); Harold T. Parker, Ph.D. (Chicago); Richard A. Preston, Ph.D. (Yale); Theodore Ropp, Ph.D. (Harvard); Richard L. Watson, Ph.D. (Yale)

The Department of History offers graduate work leading to the A.M. and Ph.D. degrees. Candidates for the A.M. degree must have a reading knowledge of at least one ancient or modern foreign language related to their programs of study and have completed successfully a substantial research paper, or two seminar papers, normally the product of a year's seminar or two semester courses. The paper(s) must be approved by two readers, the supervising professor and a second professor from the graduate staff. Students anticipating a May degree must have their papers read and approved by April 15; those anticipating a September degree must have their papers read and approved by August 1.

Candidates for the degree of Doctor of Philosophy prepare themselves for examinations in four fields, at least three of which shall be in history. The choice of fields is determined in consultation with the student's supervisor and the Director of Graduate Studies. The department offers graduate instruction in the fields of Africa, Afro-American history, ancient history, medieval and early modern Europe, modern Europe, American history, Britain and the Commonwealth, Imperial Russia, Soviet Russia, Latin America, South Asia, China, modern Japan, military history, history of science, and history of medicine. The candidate for the Ph.D. degree must have a reading knowledge of two foreign languages to be picked in conjunction with the candidate's supervisor. In certain cases, an alternative to the second language may be chosen if approved by both the candidate's supervisor and the Director of Graduate Studies. Such an alternative must take the form of successful completion of a course or courses which would appreciably increase the candidate's methodological proficiency; such as a graduate course in statistics, archaeology, demography, numismatics, cartography, or a summer training program for developing methodological skills. A course or courses in a discipline outside history—anthropology, literature, sociology, political science, ecology, geography, etc.—will not necessarily qualify as an alternative to a second language. Also, the alternative must be in addition to any previous undergraduate work in the methodology. Whether satisfied by two languages or by one language and an alternative, the requirement must be met prior to the preliminary examination.

### Courses of Instruction

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|---|---|
| 201S. The Russian Intelligentsia and the Origins of the Revolution                    | 227-228. Recent United States History: Major Political and Social Movements   |
| 202S. The Russian Revolution  | 231S, 232S. Problems in the History of Spain and the Spanish Empire           |
| 203. Topics in Modern World Environmental History                                     | 233. Slave Resistance and Social Control in New World Societies               |
| 204. German Society, 1914-1955  | 234S. Political Economy of Development: Theories of Change in the Third World |
| 207, 208. Constitutional History of Britain: The Rise of the Common Law               | 235S. The Antebellum South  |
| 215S, 216S. The Diplomatic History of the United States                               | 237S. Europe in the Early Middle Ages   |
| 219S, 220S. History of Science and Technology   | 238S. Europe in the High Middle Ages  |
| 221. Topics in the Social and Economic History of Europe, 1200-1700                   | 239S. History of Socialism and Communism                                      |
| 222. Problems in the Intellectual History of the European Renaissance and Reformation | 241-242. United States Constitutional History                                 |
| 225S. Problems in Comparative Labor History   | 243-244. Marxism and History  |
| 226. Topics in the Labor History of the United States                                 | 245, 246. Social and Intellectual History of China                            |
|   | 247. History of Modern India and Pakistan, 1707-1857                          |



248. History of Modern India and Pakistan, 1857 to the Present  
 249-250. Social and Intellectual History of the United States  
 253S, 254S. European Diplomatic History, 1871-1945  
 256. Modern Literature and History  
 260. Fifth and Fourth Century Greece  
 261. Alexander and the Hellenistic World  
 262. Problems in Soviet History  
 263. The Roman Republic  
 264. The Roman Empire  
 265S. Problems in Modern Latin American History  
 267S, 274S. England in the Sixteenth Century  
 268S. England in the Seventeenth Century  
 269S-270S. British History, Seventeenth Century to the Present  
 273S, 274S. Topics in the History of Science  
 277S. The Coming of the Civil War in the United States, 1820-1861  
 278S. The Civil War in the United States and Its Aftermath, 1861-1900

279, 280. Health, Healing, and History  
 282S. Canada  
 284S. Feminist Theory and the Social Sciences  
 285S, 286S. Oral History  
 301-302. Research Seminar in History  
 307-308. Seminar in United States History  
 312. Seminar in the Teaching of History in College  
 314. Historical and Social Science Methodology  
 351-352. Colloquia  
 371-372. Research Seminars  
 399. Special Readings

### **Courses Currently Unscheduled**

212. The American Indian in the Revolutionary Era, 1760-1800  
 229S, 230S. Revolution in Modern Europe, 1789-1919  
 259. Archaic Greece  
 266. Late Antiquity

## **The Master of Arts Program in Humanities**

Professor Charles R. Young (Cornell), *Director*

The Master of Arts Program in Humanities is an interdepartmental program and is tailored to the needs of individual students. The candidate defines a theme and selects appropriate course work with the aid and approval of a supervising committee. Thirty units of course work and proficiency in reading a foreign language are required for completion of the program. The degree may be earned with or without a thesis. The candidate who chooses not to submit a thesis will submit instead at least two substantial papers arising from course work for review by committee members, and meets with them to discuss his or her program in a final master's colloquium.

The program is open to holders of undergraduate degrees in any discipline who can demonstrate sufficient background in humanities to permit study at the graduate level. Admission is by regular application to the Graduate School. Students may enroll full time or part time (minimum of 3 units per term). Students considering entering the program may enroll in an appropriate graduate course or courses through the Office of Continuing Education, at the same time making their interests known to the Director of the Humanities Program.

## **The Master of Arts Program in Liberal Studies**

Diane Sasson, Ph.D. (North Carolina at Chapel Hill), *Director*

The Master of Arts in Liberal Studies program allows individuals with a variety of professional and personal educational goals the flexibility to pursue their interests across traditional disciplinary boundaries. The program is managed by an interdepartmental committee. Students study primarily on a part-time basis and choose from an array of interdisciplinary courses developed specifically for this program. In addition to those courses, students may select other graduate-level courses that fit their individual needs and interests.

The MALS program consists of nine courses and a final project. These courses are offered during three academic terms (fall, spring, and summer). For more information on specific courses and other program requirements, a separate bulletin on the Master of Arts in Liberal Studies may be requested from the program director (120 Allen Building, Duke University, Durham, North Carolina 27706, 684-3222).

# The Graduate Program in Literature

Professor Fredric Jameson, Ph.D. (Yale), *Chairman*

Professor Annabel Patterson, Ph.D. (London), *Director of Graduate Studies*

## Faculty

A. Leigh DeNeef, Ph.D. (Pennsylvania State); Ariel Dorfman, Licenzia en Philosophia (Univ. of Chile); Gustavo Pérez Firmat, Ph.D. (Michigan); Stanley Fish, Ph.D. (Yale); Frank Lentricchia, Ph.D. (Duke); Valentin Mudimbe, Ph.D. (Louvain); Janice Radway, Ph.D. (Michigan); James Rolleston, Ph.D. (Yale); Barbara Herrnstein Smith, Ph.D. (Brandeis); Phillip Stewart, Ph.D. (Yale); Jean-Jacques Thomas, Doctorat de 3e Cycle (Univ. of Paris); Jane Tompkins, Ph.D. (Yale)

## Resource Faculty (All have Ph.D.'s— available for advising and supervision of students)

Frank L. Borchartd, Peter Burian, Alice Kaplan, Francis Newton, Linda Orr, Lee Patterson, Clyde de Loache Ryals, Marcel Tetel, Bruce Wardropper

The Graduate Program in Literature has as its goals the education of men and women who will be fully qualified to teach in departments of national literatures as well as in the humanities and other interdisciplinary programs. The program is not comparatist in the traditional sense but theoretical in focus, dedicated to the understanding of cultural history and the reshaping of literary studies in the context of contemporary thought. The program acknowledges the challenges posed by the emergence of non-Western literatures, by the increasing importance of oppositional cultures within the West (feminism, Marxism, discourse analysis), by the significance of new media such as film, and by the relationship between verbal and nonverbal arts such as painting and music. The newly-founded Duke Center for Critical Theory supplements and enhances the goals for the Graduate Program in Literature by annual conferences, special seminars, and lectures presented by international scholars and thinkers. A full descriptive brochure is available from Professor A. Patterson, Duke University, 305 Carr Building, Durham, North Carolina 27706.

## Courses of Instruction

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|---|---|
| 251. History of Criticism                                   | 286. Topics in Legal Theory                         |
| 252. Criticism and Literary Theory in the Twentieth Century | 287. Problems in Narrative Analysis                 |
| 253. Philology, Linguistics, and the Roots of Literature    | 288. Basic Issues in the History of Literary Theory |
| 254. Introduction to Feminism                               | 289. Topics in Feminist Theory                      |
| 280. Semiotics for Literature                               | 290. Topics in Psychoanalytic Criticism             |
| 281. Paradigms of Modern Thought                            | 291. Topics in Popular Culture and the Media        |
| 282. Contemporary Literary Theory                           | 292. Topics in Non-Western Literature and Culture   |
| 283. Modernism  | 293. Literature and History                         |
| 284. The Intellectual as Writer                             | 300. Problems in the Theory of Value and Judgment   |
| 285. Literature and Ideology                                | 391. Topics in Special Readings                     |
|   | 399. Independent Studies                            |

# The University Program in Marine Sciences

Professor Joseph S. Ramus, Ph.D. (California at Berkeley), *Acting Director and Director of Graduate Student Affairs*

## Professors

John D. Costlow, Ph.D. (Duke); Richard B. Forward, Ph.D. (California at Santa Barbara); John Gutknecht, Ph.D. (North Carolina at Chapel Hill); David R. McClay,\* Ph.D. (North Carolina at Chapel Hill); Orrin Pilkey, † Ph.D. (Florida State); Richard B. Searles,\* Ph.D. (California at Berkeley)

## Associate Professors

Celia Bonaventura, Ph.D. (Texas); Joseph Bonaventura, Ph.D. (Texas); Thomas C. Johnson, Ph.D. (California at San Diego); J. Bolling Sullivan, Ph.D. (Texas); John P. Sutherland, Ph.D. (California at Berkeley)

## Assistant Professor

Daniel Rittschof, Ph.D. (Michigan at Ann Arbor)

## Professor Emeritus

Cazlyn Green Bookhout, Ph.D. (Duke)

\*In residence during summer only.

†In residence during spring only.

Graduate students from any and all academic disciplines are encouraged to take professional training at the Marine Laboratory. The program operates year-round, providing course work in the marine sciences, an active seminar program, and facilities supporting dissertation research. Resident graduate students represent the Departments of Biochemistry, Botany, Cell Biology, Geology, and Zoology, and the School of Forestry and Environmental Studies. Ordinarily, dissertation advisers are resident as well, although this need not be the case. The Marine Laboratory has available several graduate student instructional assistantships and endowed fellowships during the academic year, including summer. In addition, tuition credits obtained from fellowship support may be applied to courses given both at the Marine Laboratory and the Durham campus.

Persons interested in graduate work in marine sciences should apply through one of the appropriate departments. Forms may be obtained from the Graduate School.

Applications for summer courses at the laboratory should be addressed to the Admissions Office, Duke University Marine Laboratory, Beaufort, North Carolina 28516. Additional information and the application form are included in the *Bulletin of Duke University: Marine Laboratory*. The application for enrollment in summer courses at the laboratory should be accompanied by transcripts of undergraduate and graduate work. Applications should be received as early as possible. Graduate students planning to enroll in courses or seminars offered during the fall or spring at the Marine Laboratory should notify the Admissions Office of the Marine Laboratory of such intent *prior* to the beginning of the respective semester.

Students registering for research should do so under the appropriate departmental numbers.

The following courses are offered at Beaufort. See the Marine Laboratory bulletin for the current schedule of courses.

### Courses of Instruction

203. Physical Oceanography  
 203L. Marine Ecology  
 209S. Marine Sediments  
 209, 210. Independent Study  
 210. Individual Study  
 213L. Behavioral Ecology  
 217L. Biology of Marine Macrophytes  
 218. Barrier Island Ecology  
 219L. Benthic Marine Algae  
 250L. Physiology of Marine Animals  
 263L. Tropical Seaweeds  
 274L. Marine Invertebrate Zoology  
 278L. Invertebrate Developmental Biology

295S. Advanced Topics in Geology: Continental Margin Sedimentation  
 353, 354. Research  
 359, 360. Research  
 371, 372. Advanced Topics in Geology  
 \_\_\_\_\_ . Seminar

### Courses Currently Unscheduled

245L. Macromolecules, Ecology, and Evolution  
 247L. Plant Ecology  
 266S. Marine Biochemistry and Genetics  
 276. Comparative and Evolutionary Biochemistry

## Mathematics

Professor Michael C. Reed, Ph.D. (Stanford), *Chairman*

Professor J. Thomas Beale, Ph.D. (Stanford), *Director of Graduate Studies*

### Professors

William K. Allard, Ph.D. (Brown); Robert L. Bryant, Ph.D. (University of North Carolina), *Arts and Sciences Professor of Mathematics*; Phillip A. Griffiths, Ph.D. (Princeton); David G. Schaeffer, Ph.D. (Massachusetts Inst. of Tech.); Joseph R. Schoenfeld, Ph.D. (Michigan); Seth L. Warner, Ph.D. (Harvard); Morris Weisfeld, Ph.D. (Yale)

### Associate Professors

Donald S. Burdick, Ph.D. (Princeton); Richard E. Hodel, Ph.D. (Duke); Joseph W. Kitchen, Jr., Ph.D. (Harvard); David P. Kraines, Ph.D. (Univ. of California at Berkeley); Gregory F. Lawler, Ph.D. (Princeton); Lawrence C. Moore, Ph.D. (Cal. Tech.); David R. Morrison, Ph.D. (Harvard); William L. Pardon, Ph.D. (Princeton); Leslie Saper, Ph.D. (Princeton); Richard A. Scoville, Ph.D. (Yale); David A. Smith, Ph.D. (Yale); Mark Stern, Ph.D. (Princeton); Stephanos Venakides, Ph.D. (Courant)

### Assistant Professors

Margaret Cheney, Ph.D. (Indiana); Carl Gardner, Ph.D. (Massachusetts Inst. of Tech.); Harold E. Layton, Ph.D. (Duke); Dana W. Nance, Ph.D. (Princeton); Vassilis Papanicolaou, Ph.D. (Stanford); Chadmark L. Schoen, Ph.D. (Chicago)



### Adjunct Professor

Jagdish Chandra, Ph.D. (Rensselaer)

### Visiting Assistant Professors

Heisuke Hironaka, Ph.D. (Harvard); Harsh V. Pittie, Ph.D. (Princeton)

Graduate work in the Department of Mathematics is offered leading to the A.M. and Ph.D. degrees. Admission to these programs is based on the applicant's undergraduate academic record, level of preparation for graduate study, the Graduate Record Examination, and letters of recommendation.

All A.M. and Ph.D. candidates are required to pass a qualifying examination after completing their first year of graduate study. The A.M. degree with a major in mathematics is awarded upon completion of 30 units of graded course work and passing the qualifying examination. A thesis may be substituted for 6 units of course work only under special circumstances.

Soon after the student who is pursuing a Ph.D. degree passes the qualifying examination, the Director of Graduate Studies appoints a committee of two graduate faculty members who determine the conditions to be met by the student before he or she takes the preliminary examination. Normally, this committee forms the nucleus of the student's advisory committee. The conditions may include a reading knowledge of one or more foreign languages appropriate to the student's intended area of specialization, an appropriate level of computer programming proficiency, or specific course work.

Candidacy for the Ph.D. is established by passing an oral preliminary examination. The preliminary examination is normally taken at the beginning of the third year. The preliminary examination is conducted by a committee selected by the rules of the Graduate School and the department. The examination can, at the student's option, consist of questions based either on the student's course work at Duke or on the specific area of research plus a minor subject selected by the student.

After admission to candidacy, the Ph.D. degree is awarded on the basis of the student's scholarly ability as demonstrated by the dissertation and its defense. The dissertation is the most important requirement in the award of the Ph.D. degree.

### Courses of Instruction

- |   |   |
|---|---|
| 200. Introduction to Algebraic Structures I             | 271. Algebraic Topology                       |
| 201. Introduction to Algebraic Structures II            | 273. Algebraic Geometry                       |
| 203. Basic Analysis I                                   | 275. Differential Geometry                    |
| 204. Basic Analysis II                                  | 276. Topics in Differential Geometry          |
| 205. Topology   | 277. Topics in Algebraic Geometry             |
| 206. Differential Geometry                              | 278, 279. Topics in Topology                  |
| 221. Numerical Analysis I                               | 280. Differential Analysis                    |
| 222. Numerical Differential Equations                   | 281. Real Analysis I                          |
| 223. Numerical Linear Algebra                           | 282. Real Analysis II                         |
| 230. Mathematical Methods in Physics and Engineering I  | 283. Linear Operators                         |
| 231. Mathematical Methods in Physics and Engineering II | 284. Topics in Functional Analysis            |
| 233. Asymptotic and Perturbation Methods                | 285. Complex Analysis                         |
| 234. Mathematics for Quantum Mechanics                  | 286. Topics in Complex Analysis               |
| 235. Topics in Mathematical Physics                     | 288, 289. Topics in Analysis                  |
| 238, 239. Topics in Applied Mathematics                 | 290. Probability                              |
| 240. Applied Stochastic Processes                       | 293, 294. Topics in Probability Theory        |
| 241. Linear Models                                      | 295. Fourier Analysis and Distribution        |
| 242. Multivariate Statistics                            | 296. Ordinary Differential Equations          |
| 245. Functional Analysis for Scientific Computing       | 297. Partial Differential Equations I         |
| 250. Introductory Mathematical Logic                    | 298. Partial Differential Equations II        |
| 251. Set Theory I                                       | 299. Topics in Partial Differential Equations |
| 252. Set Theory II                                      | 378-379. Current Research in Topology         |
| 253. Recursion Theory                                   | 388, 389. Current Research in Analysis        |
| 258, 259. Topics in Logic                               |   |
| 260. Groups, Rings, and Fields                          |   |
| 261. Commutative Algebra                                |   |
| 268, 269. Topics in Algebra                             |   |

### Courses Currently Unscheduled

- 358-359. Current Research in Logic
- 368-369. Current Research in Algebra
- 387. Current Research in Mathematical Physics

# Program in Medieval and Renaissance Studies

Professor Lee Patterson, Ph.D. (Yale), *Chairman*

Professor Charles R. Young, Ph.D. (Cornell), *Director of Graduate Studies*

The graduate Program in Medieval and Renaissance Studies is an interdisciplinary program administered by the Duke University Center for Medieval and Renaissance Studies. In consultation with the Director of Graduate Studies, students in the program select courses in art, history, music, philosophy, religion, language, and literature (classical studies, English, German, and Romance languages). The program is described in the section on special programs; for a description of individual courses see the large *Bulletin of Duke University: Graduate School*.

## Courses of Instruction

### Department of Art and Art History

230S. Medieval and Byzantine Art and Architecture

232S. Romanesque and Gothic Art and Architecture

234. Medieval Architecture

242S. Studies in Italian Renaissance Art

243S. Studies in Northern Art

### Department of Classical Studies

221. Medieval Latin

### Department of English

208. History of the English Language

210. Old English Literary Tradition

221. Middle English Literature: 1100 to 1500

221. Renaissance Prose and Poetry: 1500 to 1660

225. Renaissance Drama: 1500 to 1642

310. Studies in Old English Literature

312. Studies in Middle English Literature

315. Studies in Chaucer

321. Studies in Renaissance Literature

324. Studies in Shakespeare

329. Studies in Milton

### Department of Germanic Languages and Literature

205, 206. Middle High German

215S. Seventeenth-Century Literature

216. History of the German Language

217S. Renaissance and Reformation Literature

### Department of History

207. Constitutional History of Britain:

The Rise of the Common Law

222. Problems in the Intellectual History of the

European Renaissance and Reformation

237S. Europe in the Early Middle Ages

238S. Europe in the High Middle Ages

267S-268S. From Medieval to Early Modern England

### Department of Music

211. Medieval Notation

212. Renaissance Notation

222. Music in the Middle Ages

223. Music in the Renaissance

317S. Seminar in the History of Music

341S. History of Music Theory to Rameau

351S. Studies in Musical Iconography

361S. Music Organology

### Department of Philosophy

218S. Medieval Philosophy

219S. Late Medieval and Renaissance Philosophy

### Department of Religion

219. Augustine

236. Luther and the Reformation in Germany

337. Theology of St. Thomas Aquinas

338. Calvin and the Reformed Tradition

339. The Radical Reformation

### Department of Romance Studies

#### *French*

211. History of the French Language

240. Old French Literature

248. French Literature of the Seventeenth Century

325. French Prose of the Sixteenth Century

326. Topics in Renaissance Poetry

391, 392. French Seminar (medieval and Renaissance topics)

#### *Italian*

284, 285. Dante

#### *Spanish*

210. History of the Spanish Language

251. The Origins of Spanish Prose Fiction

253. Cervantes

254. Drama of the Golden Age

258. Spanish Lyric Poetry before 1700

391, 392. Hispanic Seminar (medieval and Renaissance topics)

## Courses Currently Unscheduled

Classical Studies 327. Seminar in Byzantine History

English 383. Textual Criticism

Religion 206. Christian Mysticism in the Middle Ages

Religion 241. Problems in Reformation Theology

Religion 251. The Counter-Reformation and the Development of Catholic Dogma

Religion 334. Theology and Reform in the Later Middle Ages

Religion 344. Zwingli and the Origins of Reformed Theology

# Microbiology and Immunology

Professor Wolfgang Karl Joklik, D.Phil. (Univ. of Oxford), *James B. Duke Professor of Microbiology and Immunology and Chairman*

Professor Hilda Pope Willett, Ph.D. (Duke), *Director of Graduate Studies*

## Professors

D. Bernard Amos, M.D. (Guys Hospital, London), *James B. Duke Professor of Immunology*; Deepak Bastia, Ph.D. (Chicago); Dani P. Bolognesi, Ph.D. (Duke); Rebecca Buckley, M.D. (North Carolina at Chapel Hill); Peter Cresswell, Ph.D. (University of London); Jack D. Keene, Ph.D. (Washington at Seattle); David R. McClay, Ph.D. (North Carolina at Chapel Hill); Richard S. Metzgar, Ph.D. (Buffalo); Joseph R. Nevins, Ph.D. (Duke); Suydam Osterhout, M.D. (Duke), Ph.D. (Rockefeller University); Wendell F. Rosse, M.D. (Chicago); Hilliard F. Seigler, M.D. (North Carolina at Chapel Hill); Frances E. Ward, Ph.D. (Brown); Robert W. Wheat, Ph.D. (Washington)

## Associate Professors

Dolph O. Adams, M.D., Ph.D. (North Carolina at Chapel Hill); Ronald B. Corley, Ph.D. (Duke); Jeffrey R. Dawson, Ph.D. (Case Western Reserve); Sharyn Endow, Ph.D. (Yale); Warner C. Greene, M.D., Ph.D. (Washington); Barton F. Haynes, M.D. (Baylor); Elwood A. Linney, Ph.D. (California at San Diego); Thomas G. Mitchell, Ph.D. (Tulane); Harvey J. Sage, Ph.D. (Yale)

## Assistant Professors

Yair Argon, Ph.D. (Harvard Medical School); C. Edward Buckley III, M.D. (Duke); Olivera J. Finn, Ph.D. (Stanford); Kenneth N. Kreuzer, Ph.D. (Chicago); Michael C. Ostrowski, Ph.D. (South Carolina at Columbia); David J. Pickup, Ph.D. (National Institute of Medical Research, London); David S. Pisetsky, M.D., Ph.D. (Albert Einstein)

## Associate Medical Research Professors

Andrew E. Balber, Ph.D. (Rockefeller University); Sara E. Miller, Ph.D. (Georgia)

## Assistant Medical Research Professors

Mary Vickers Burdett, Ph.D. (Georgetown); Kay H. Singer, Ph.D. (Duke)

The Department of Microbiology and Immunology offers graduate training leading to a Ph.D. degree. It is a participating department in interdisciplinary University Programs in Genetics and Cell and Molecular Biology, and in the Medical Scientist Training Program. Sixty-six predoctoral students and forty-five postdoctoral fellows are currently in residence.

The curriculum of the graduate program is designed to provide students with basic training in virology, prokaryotic and eukaryotic molecular cell biology, molecular genetics, and immunology. This part of the program, which takes from eight to sixteen months, is composed of formal course work and laboratory and library research. Research training is stressed throughout the program and is available in all of the 32 well-equipped research laboratories of the department. Expertise in a broad cross-section of molecular genetics and cell biology is represented, including techniques of DNA and RNA sequencing, genetic engineering, and hybridoma technology. Research programs are available in molecular virology, viral oncology, molecular cell biology, cellular differentiation and development, tumor cell biology, cell-surface immunochemistry, medical mycology, immunogenetics, tumor immunology, molecular immunology, and cellular immunology.

Undergraduate preparation in the biological and physical sciences and in biochemistry is required. A brochure describing the Ph.D. degree program, prerequisites for admission, financial support and research in the department may be obtained by writing the Director of Graduate Studies, Box 3020, Duke University Medical Center, Durham, North Carolina 27710.

## Courses of Instruction

- |  |  |
|--|--|
| 214. Fundamentals of Electron Microscopy             | 291. Comprehensive Immunology              |
| 219. Molecular and Cellular Bases of Differentiation | 304. Molecular Membrane Biology            |
| 221. Medical Microbiology                            | 310. Molecular Development                 |
| 234. Introduction to Biostatistical Methods          | 323. Topics in Cell and Molecular Biology  |
| 244. Principles of Immunology                        | 324. Topics in Molecular Genetics          |
| 246S. Parasitic Diseases                             | 325. Medical Mycology                      |
| 252. General Virology and Viral Oncology             | 330. Medical Immunology                    |
| 259. Molecular Biology I: Proteins and Enzymes       | 331.1-331.8. Microbiology Seminar          |
| 268. Molecular Biology II: Nucleic Acids             | 332.1-332.8. Immunology Seminar            |
| 269. Advanced Cell Biology                           | 336. Contemporary Topics in Immunogenetics |



# Music

Professor Alexander Silbiger, Ph.D. (Brandeis), *Chairman*

Professor Tilman Seebass, Ph.D. (University of Basel), *Director of Graduate Studies*

## Professor

Peter Williams, Ph.D., Litt.D. (Cambridge)

## Associate Professors

Stephen Jaffe, A.M. (Pennsylvania); R. Larry Todd, Ph.D. (Yale)

## Assistant Professors

M. Elizabeth C. Bartlet, Ph.D. (Chicago); Bryan Gilliam, Ph.D. (Harvard); Paula Higgins, Ph.D. (Princeton);

Robert Hill, Ph.D. (Harvard)

## Adjunct Assistant Professor

John Druessedow, Jr., Ph.D. (Univ. of Indiana), *Director of Music Library*

The Department of Music offers graduate programs leading to the A.M. and Ph.D. degrees in musicology, the A.M. degree in composition and the A.M. degree in performance practice. The department has traditionally emphasized the study of music within the framework of cultural and intellectual history. To this has been added more recently emphasis on performance practice. In addition, there is a strong interest, within both the composition and musicology programs, in opera and musical theater. Students are encouraged to include work outside their main area of concentration in their degree programs. They also may be admitted to the Program in Medieval and Renaissance Studies (see section on Medieval and Renaissance Studies).

Nondegree students and especially graduate students from other departments may be admitted to graduate courses by consent of the instructor, according to their level of achievement in the proposed area of study. A reading knowledge of one foreign language is required for the A.M. in composition, musicology, and performance practice; a minimum of two languages are required for the Ph.D. (one of which will normally need to be German). For many dissertation topics a third language may be required. A detailed description of the requirements for the A.M. and Ph.D. is available upon request from the Director of Graduate Studies.

## Courses of Instruction

- |  |   |
|--|---|
| 201. Introduction to Musicology                  | 295S. Composition Seminar   |
| 203. Proseminar in Performance Practice          | 296S. Analysis of Contemporary Music  |
| 211, 212. Notation                               | 297, 298, 299. Composition  |
| 213. Theories and Notation of Contemporary Music | 317S. Seminar in the History of Music                                       |
| 215. Music Analysis                              | 318S. Seminar in Performance Practice                                       |
| 216. Analysis of Twentieth-Century Music         | 331, 332, 333. Independent Study in Performance Practice and Interpretation |
| 222. Music in the Middle Ages                    | 341S. History of Music Theory to Rameau                                     |
| 223. Music in the Renaissance                    | 351S. Studies in Musical Iconography  |
| 224. Music in the Baroque Era                    | 361S. Musical Organology  |
| 225. Music in the Classic Era                    | 382S. Studies in Ethnomusicology  |
| 226. Music in the Nineteenth Century             | 390. Independent Study  |
| 227. Music in the Twentieth Century              |   |
| 236. Nineteenth-century Piano Music              |   |

## Neurobiology

Professor William C. Hall, Ph.D. (Duke), *Interim Chairman*

Professor Sidney A. Simon, Ph.D. (Northwestern), *Director of Graduate Studies*

## Professors

Mohamed B. Abou-Donia, Ph.D. (California at Berkeley); James N. Davis, M.D. (Cornell); Irving T. Diamond, Ph.D. (Johns Hopkins); John W. Moore, Ph.D. (Virginia); J. David Robertson, Ph.D. (Harvard), M.D. (Massachusetts Institute of Technology); Allen D. Roses, M.D. (Pennsylvania); George G. Somjen, M.D. (Amsterdam), Ph.D. (New Zealand); John Staddon, Ph.D. (Harvard)

## Associate Professors

Peter B. Bennett, Ph.D., M.D. (Southampton); Nell B. Cant, Ph.D. (Ann Arbor); Joseph M. Corless, M.D., Ph.D. (Duke); Robert P. Erickson, Ph.D. (Brown); J. Victor Nadler, Ph.D. (Illinois); Myron L. Wolbarsht, Ph.D. (Johns Hopkins)

#### Assistant Professors

Robert R. H. Anholt, Ph.D. (California at San Diego); Barbara J. Crain, M.D., Ph.D. (Duke); David Fitzpatrick, Ph.D. (Duke); Darrell V. Lewis, M.D. (Minnesota)

#### Professor Emeritus

John W. Everett, Ph.D. (Yale)

#### Associate Medical Research Professors

John. H. Casseday, Ph.D. (Indiana at Bloomington); Michael L. Hines, Ph.D. (Chicago)

#### Assistant Medical Research Professors

Peter G. Aitken, Ph.D. (Connecticut); Gillian Einstein, Ph.D. (Pennsylvania at Philadelphia); Pedro Labarca, Ph.D. (Brandeis); Denis Raczkowski, Ph.D. (Duke)

#### Adjunct Assistant Professors

Thomas W. Anderson, Ph.D. (Duke); Virgil Holland, Ph.D. (South Carolina at Columbia); Chia-Sheng Lin, Ph.D. (Vanderbilt)

Neurobiology is concerned with accounting for behavior in terms of the form, function, evolution, and development of structures in nervous systems. A wide range of tools and approaches are used in neuroscience research. These include: *light and electron microscopy* to reveal neuron and supporting cell shapes and connections as well as to visualize labeled antibodies to identify the constituents of neural tissue; *electrical recording* to measure electrical activity from individual cells and collections of cells at macroscopic and microscopic levels (these measurements include voltage and patch clamping of individual cells); *optical recording* ranging from noninvasive studies of intracellular messengers to detecting impulses in spatially distributed cells; *biochemical techniques* to identify the chemical machinery involved in signal transduction and cell regulation; *molecular biology* to determine the effects of perturbations of molecular constituents on development and macromolecule function; and *computer simulations* to understand functioning of neurons and neuron networks.

#### Courses of Instruction

202. Basic Neurobiology

208. Cellular Physiology of Nervous Tissue I

209. Cellular Physiology of Nervous Tissue II

210. Individual Study

222. Behavioral and Neural Modeling

225. Neurobiology of Sensory Systems

266S. Comparative Neurobiology

280. Student Seminar

302. Anatomy and Physiology of the Central Nervous System

310. Frontiers in Neurobiology

360. Neuropharmacology

364. Neurotoxicology

370. Neurobiology I

372. Research in Neurobiology

## Pathology

Professor Robert B. Jennings, M.D. (Northwestern), *James B. Duke Professor of Pathology and Chairman*  
Professor Darell D. Bigner, M.D., Ph.D. (Duke), *Edwin L., Jr. and Lucille Finch Jones Cancer Research Professor of Pathology and Director of Graduate Studies*

#### Professors

Dolph O. Adams, M.D., Ph.D. (North Carolina at Chapel Hill); Sandra H. Bigner, M.D. (Tennessee); Edward H. Bossen, M.D. (Duke); William D. Bradford, M.D. (Western Reserve); Peter C. Burger, M.D. (Northwestern); Bernard F. Fetter, M.D. (Duke); Doyle G. Graham, M.D., Ph.D. (Duke); Donald B. Hackel, M.D. (Harvard); William W. Johnston, M.D. (Duke); Gordon K. Klintworth, M.D., Ph.D. (Univ. of Witwatersrand); John A. Koepke, M.D. (Wisconsin at Madison); George Michalopoulos, M.D., Ph.D. (Wisconsin); Salvatore V. Pizzo, M.D., Ph.D. (Duke); Philip Pratt, M.D. (Johns Hopkins); John D. Shelburne, M.D., Ph.D. (Duke); Joachim R. Sommer, M.D. (Munich); F. Stephen Vogel, M.D. (Western Reserve); Benjamin Wittels, M.D. (Minnesota)

#### Associate Professors

Jane G. Elchlepp, M.D. (Iowa), Ph.D. (Chicago); Raymond E. Ideker, M.D. (Tennessee); Kenneth Scott McCarty, Jr., M.D., Ph.D. (Duke); Keith Arnold Reimer, M.D., Ph.D. (Northwestern); Alfred P. Sanfilippo, M.D., Ph.D. (Duke); John D. Shelburne, M.D., Ph.D. (Duke); Peter Zwadyk, Jr., Ph.D. (Iowa)

#### Assistant Professors

John Lloyd Abernethy, Ph.D. (Duke); James D. Crapo, M.D. (Rochester); Randy L. Jirtle, Ph.D. (Wisconsin); Stanley C. Schold, Jr., M.D. (Arizona); Michael R. Zalutsky, Ph.D. (Washington University)

#### Associate Medical Research Professor

Carol J. Wikstrand, Ph.D. (North Carolina at Chapel Hill)

#### Assistant Clinical Professor

Robin T. Vollmer, M.D. (Duke)

**Adjunct Associate Professor**

James A. Swenberg, D.V.M. (Minnesota), Ph.D. (Ohio State)

**Adjunct Assistant Professor**

Arnold R. Brody, Ph.D. (Colorado State)

The Department of Pathology offers graduate work leading to the M.S. and Ph.D. degrees with areas of specialization such as subcellular and molecular pathology. Course work is designed to give a broad background in classical and modern pathology with emphasis on the application of modern research techniques. Students will be required to take such courses as are necessary to obtain a broad foundation, as well as courses applicable to areas of speciality and research. Further information including brochures giving details of departmental facilities, staff, trainee stipends, and the M.D.-Ph.D. program are available from the Director of Graduate Studies.

**Courses of Instruction**

- 219. Molecular and Cellular Bases of Differentiation
- 250. General Pathology
- 251. Laboratory Course in General Pathology
- 258. Cellular and Subcellular Pathology
- 275. Fundamentals of Electron Microscopy and Biological Microanalysis
- 325. Cardiovascular Pathology
- 353. Advanced Neuropathology
- 355. Graduate Seminar in Pathology
- 357. Research in Pathology
- 361, 362. Autopsy Pathology
- 364. Systemic Pathology

- 367. Special Topics in Pathology
- 369. Ophthalmic Pathology
- 370. Developmental Pathology and Teratology
- 374. Pulmonary Pathology and Postmortem Pathophysiology
- 377. Pathology of the Kidney
- 380. Diagnostic Immunology
- 381. Cancer Biology
- 382. General Pathology for Toxicologists

**Courses Currently Unscheduled**

- 360. Cytochemistry

**Pharmacology**Professor Saul M. Schanberg, Ph.D., M.D. (Yale), *Acting Chairman*Professor Elliott Mills, Ph.D. (Columbia), *Director of Graduate Studies***Professors**

Mohamed Bahie Abou-Donia, Ph.D. (California at Berkeley); Everett H. Ellinwood, Jr., M.D. (North Carolina at Chapel Hill); Norman Kirshner, Ph.D. (Pennsylvania State); Leon Lack, Ph.D. (Columbia); J. Victor Nadler, Ph.D. (Yale); Athos Ottolenghi, M.D. (Univ. of Pavia); Theodore A. Slotkin, Ph.D. (Rochester); Harold C. Strauss, M.D. (McGill); Walter D. Watkins, Ph.D. (Michigan), M.D. (Colorado); Pelham Wilder, Jr., Ph.D. (Harvard)

**Associate Professors**

James N. Davis, M.D. (Cornell); Cynthia Moreton Kuhn, Ph.D. (Duke); James O. McNamara, M.D. (Michigan); Charles B. Nemeroff, Ph.D., M.D. (North Carolina at Chapel Hill); A. Richard Whorton, Ph.D. (Vanderbilt)

**Assistant Professors**

Clinton Donald Kilts, Ph.D. (Michigan State); Rochelle D. Schwartz, Ph.D. (Georgetown)

**Professor Emeritus**

Frederick Bernheim, Ph.D. (Univ. of Cambridge), *James B. Duke Professor Emeritus of Pharmacology*

**Medical Research Professor**

Gertrude B. Elion, D.M.Sc. (Brown)

**Associate Medical Research Professor**

Wilkie A. Wilson, Jr., Ph.D. (Duke)

**Assistant Medical Research Professors**

Jorge V. Bartolome, Ph.D. (Chile); Daniel M. Lapadula, Ph.D. (New York University); Frederic J. Seidler, Ph.D. (Duke); Robert L. Wolpert, Ph.D. (Princeton)

The Department of Pharmacology offers a graduate program which leads to the Ph.D. degree. Training is available in the following areas: neuropharmacology, developmental, toxicological, biochemical, cardiovascular, molecular, and behavioral pharmacology.

**Courses of Instruction**

- 200. Pharmacology: Mode Action of Drugs
- 210, 211. Individual Study and Research
- 219. Tutorial in Pharmacology
- 233. Principles of Pharmacology and Toxicology I

- 254. Mammalian Toxicology
- 280. Student Seminar in Pharmacology
- 331. Laboratory Methods in Pharmacology
- 347, 348. Seminar in Toxicology



## Philosophy

Professor David H. Sanford, Ph.D. (Cornell), *Chairman*

Associate Professor Robert N. Brandon, Ph.D. (Harvard), *Director of Graduate Studies*

### Professors

Martin P. Golding, Ph.D. (Columbia); Edward P. Mahoney, Ph.D. (Columbia)

### Associate Professor

Carl J. Posy, Ph.D. (Yale)

### Assistant Professors

Michael T. Ferejohn, Ph.D. (California at Irvine); Marcia Lind, Ph.D. (Massachusetts Institute of Technology); Marshall R. Roderick, Ph.D. (Texas at Austin)

### Professors Emeriti

William Bernard Peach, Ph.D. (Harvard); Paul Welsh, Ph.D. (Cornell)

The Department of Philosophy offers graduate work leading to the A.M. and Ph.D. degrees. Tutorial work complements formal instruction. Students may, after taking a balanced program, specialize in any of the following fields: the history of philosophy, logic, philosophy of science, epistemology, metaphysics, philosophy of mind, philosophical analysis, ethics, aesthetics, political philosophy, philosophy of law, philosophy of medicine, and philosophy of religion.

Individual programs of study are developed for each student. Prior to being admitted to candidacy for the Ph.D. degree, the student must demonstrate a competence in one foreign language and must successfully complete a series of essays and examinations covering the following: logic and formal philosophy; value theory; metaphysics, epistemology, and philosophy of science; and the history of philosophy. In these exercises students are expected to combine factual knowledge with critical understanding.

Work in a minor or related field, not necessarily confined to any one department, is encouraged but not required. A minor normally includes 6 units for the A.M. or the Ph.D. degree and may include more as a student's program requires or permits.

A student who meets the general requirements of the Graduate School may earn the A.M. degree in philosophy by passing an oral master's examination. This examination, which can be the defense of either a master's thesis or an alternative academic exercise approved by the department and the student's committee, is normally given in the student's fourth term of full-time registration. The examination can be given earlier in two special circumstances:

1. A student with a strong undergraduate background in philosophy who satisfies the department of his or her qualifications by submitting several samples of written work before beginning the program may be admitted to the master's program with the understanding that the master's examination can be given in the second or third term of full-time registration.

2. A student who combines the A.M. program in philosophy with another advanced degree program, such as the programs for the J.D., the M.D., or the Ph.D. in another field, will register as a full-time graduate student of philosophy for only two terms, the minimum registration that meets the general requirements of the Graduate School for the A.M. degree. These two terms of full-time registration need not be consecutive, and their position in the student's overall program is determined in individual cases. A student in a combined program will normally do some work in philosophy while registered in the student's primary program and do some work in the primary field while registered in philosophy. The master's examination can be given in the second term of full-time registration as a philosophy graduate student or in a later term when the student is registered in the primary program.

A student in the philosophy Ph.D. program who meets the general requirements of the Graduate School for the A.M. degree may earn this degree by passing the preliminary for the Ph.D. degree.

A reading knowledge of at least one foreign language, ancient or modern, is required for the Ph.D. degree. Students may not take their preliminary examinations until they have demonstrated this ability. More than one language may be required where this is judged appropriate to the research demanded by the candidate's dissertation.

### Courses of Instruction

- |  |   |
|--|---|
| 203S. Contemporary Ethical Theories            | 234S. Problems in the Philosophy of Biology       |
| 204S. Philosophy of Law                        | 235S. Nineteenth-Century German Philosophy        |
| 205S. Topics in Philosophy of History          | 250S. Topics in Formal Philosophy                 |
| 206S. Responsibility                           | 251S. Epistemology                                |
| 208S. Political Values                         | 252S. Metaphysics                                 |
| 211S. Plato                                    | 253S. Philosophy of Mind                          |
| 217S. Aristotle                                | 254S. Philosophy of Religion                      |
| 218S. Medieval Philosophy                      | 291S, 292S. Special Fields of Philosophy          |
| 219S. Late Medieval and Renaissance Philosophy | 300. Problems in the Theory of Value and Judgment |
| 225S. British Empiricism                       | 311. Philosophy and Medicine                      |
| 227S. Continental Rationalism                  |   |
| 228S. Recent and Contemporary Philosophy       |   |
| 230S. The Meaning of Religious Language        |   |
| 231S. Kant's <i>Critique of Pure Reason</i>    |   |
| 233S. Methodology of the Empirical Sciences    |   |

### Courses Currently Unscheduled

- 202S. Aesthetics: The Philosophy of Art
- 232S. Recent Continental Philosophy
- 331, 332. Seminar in Special Fields of Philosophy

## Physical Therapy

Professor Robert C. Bartlett, M.A. (New York Univ.), *Chairman*  
Associate Professor Eleanor F. Branch, Ph.D. (Duke), *Director of Graduate Studies*

### Associate Professors

Terry R. Malone, Ed.D. (Duke); Elia E. Villanueva, A.M. (Duke)

### Assistant Professors

Pamela W. Duncan, M.A.C.T. (North Carolina at Chapel Hill); Janet L. Gwyer, Ph.D. (North Carolina at Chapel Hill); Grace C. Horton, B.S. (Albright)

### Assistant Clinical Professor

Mary Ellen Riordan, M.S. (Wisconsin)

### Clinical Associates

Julie M. Chandler, M.S. (Duke); Rebecca H. Crouch, M.S. (North Carolina at Chapel Hill); Daniel V. Dore, M.P.A. (Maine); Linda M. Lawrence, B.S. (SUNY at Buffalo)

The Department of Physical Therapy offers an entry level professional program leading to the M.S. degree. To be eligible for admission to the program, applicants must have obtained a baccalaureate degree and have a background in the basic sciences and social sciences, including course work in biology, chemistry, physics, and psychology.

The program is designed to provide for integration of classroom knowledge and clinical learning experiences essential for the competent practice of physical therapy. In view of this integrated curriculum, failure in a major course within a semester would prevent the student from continuing in the program. Major courses are all courses offered by the Department of Physical Therapy as well as required courses offered by the Department of Biological Anthropology and Anatomy and the Department of Neurobiology. A grade of *F* (or *noncredit* in the case of Physical Therapy 342, 343, and 344) in any of these courses will occasion withdrawal from the program. Program requirements also include a comprehensive examination, at the completion of the curriculum, and a research project. Further information may be obtained from the Director of Graduate Studies, Department of Physical Therapy, Box 3965, Duke University Medical Center, Durham, North Carolina 27710.

### Courses of Instruction

- |  |  |
|--|--|
| 210. Independent Study                   | 318. Arthrology and Pathokinesiology             |
| 301. Introduction to Scientific Inquiry  | 319. Introduction to Evaluation and Patient Care |
| 303. Research                            | 320. Evaluation and Therapeutic Procedures I     |
| 313. Physical Agents                     | 321. Evaluation and Therapeutic Procedures II    |
| 314. Electrotherapy and Electrodiagnosis | 322. Evaluation and Therapeutic Procedures III   |
| 317. Kinesiology                         |  |

- 332. Physical Therapy and Health Services: Administration and Issues
- 333. Human Development: Pediatrics/Geriatrics
- 334. Introductory Pathology
- 335. Orthopedics
- 336. Medical Sciences
- 340. Special Topics in Physical Therapy
- 342. Directed Clinical Experience in Physical Therapy I

- 343. Directed Clinical Experience in Physical Therapy II
- 344. Directed Clinical Experience in Physical Therapy III

### Courses Currently Unscheduled

- 302. Research
- 304. Seminar in Applied Neurophysiology
- 324. Prosthetics and Orthotics

## Physics

Professor Lawrence E. Evans, Ph.D. (Johns Hopkins), *Chairman*

Professor Alfred T. Goshaw, Ph.D. (Wisconsin), *Director of Graduate Studies*

### Professors

L. C. Biedenharn, Jr., Ph.D. (Massachusetts Inst. of Tech.); Edward G. Bilpuch, Ph.D. (North Carolina at Chapel Hill); Frank C. DeLucia, Ph.D. (Duke); Lloyd Fortney, Ph.D. (Wisconsin); Moo-Young Han, Ph.D. (Rochester); Eric Herbst, Ph.D. (Harvard); John M. J. Madey, Ph.D. (Stanford); Johannes Horst Max Meyer, Ph.D. (Univ. of Geneva); N. Russell Roberson, Ph.D. (Johns Hopkins); Hugh G. Robinson, Ph.D. (Duke); William D. Walker, Ph.D., (Cornell); Richard L. Walter, Ph.D. (Notre Dame); Henry R. Weller, Ph.D. (Duke)

### Associate Professors

Robert P. Behringer, Ph.D. (Duke); Henry S. Greenside, Ph.D. (Princeton); Richard G. Palmer, Ph.D. (Cambridge); John Thomas, Ph.D. (Massachusetts Inst. of Tech.)

### Assistant Professors

Calvin R. Howell, Ph.D. (Duke); Seog Hwan Oh, Ph.D. (Massachusetts Inst. of Tech.); Stephen W. Teitsworth (Harvard)

### Professors Emeriti

Henry A. Fairbank, Ph.D. (Yale); Harold W. Lewis, Ph.D. (Duke)

### Adjunct Professors

Mikael Ciftan, Ph.D. (Duke); B.D. Guenther, Ph.D. (University of Missouri); G. Allan Johnson (Duke); Fearghus O'Foghludha, Ph.D. (National Univ. of Ireland); Herman R. Robl, Ph.D. (Univ. of Vienna); Michael A. Stroschio (Yale)

The Department of Physics offers graduate work for students wishing to earn the A.M. or Ph.D. degree. In addition to a balanced program of basic graduate courses, the department offers specialized courses and seminars in several fields in which research is being done by faculty and staff.

With the help of faculty advisers, students select a course program to fit their needs, including work in a related field, usually mathematics or chemistry. Students are encouraged to begin research work early in their careers.

### Courses of Instruction

- 211. Modern Physics
- 213. Introduction to Nonlinear Dynamics
- 214. Introduction to Solid-State Physics
- 215. Introduction to Quantum Mechanics
- 217S, 218S. Advanced Physics Laboratory and Seminar
- 220. Electronics
- 240. Computer Applications to Physical Measurement
- 244. Nuclear and Particle Physics
- 302. Advanced Mechanics
- 303. Statistical Mechanics
- 304. Advanced Topics in Statistical Mechanics\*
- 305. Introduction to Nuclear Physics
- 308. Introduction to High-Energy Physics
- 309. Solid-State Physics I
- 316. Principles of Quantum Theory
- 317. Intermediate Quantum Theory
- 318-319. Electromagnetic Field Theory
- 331. Quantum Electronics

- 333. Electronic Properties of Submicron Solid State Devices
- 334. Atomic Physics and Spectroscopy
- 335. Molecular Spectroscopy
- 341. Advanced Topics in Quantum Theory
- 345. Advanced High Energy Physics
- 351, 352. Seminar

### Courses Currently Unscheduled

- 306. Low Temperature Physics
- 310. Solid-State Physics II
- 312. Phase Transitions and Critical Phenomena
- 330. Nuclear Structure Theory
- 342. Theory of Elementary Particles
- 343. Nuclear Physics
- 344. Advanced Nuclear Physics
- 346. Topics in Theoretical Physics
- 397, 398. Low Temperature and Solid-State Seminar

## Political Science

Professor Allan Kornberg, Ph.D. (Michigan), *Chairman*

\*Offered on demand.



#### Professors

John Aldrich, Ph.D. (Rochester); William Louis Ascher, Ph.D. (Yale); James D. Barber, Ph.D. (Yale), *James B. Duke Professor of Political Science*; Robert Bates, Ph.D. (Massachusetts Inst. of Tech.), *Luce Professor of Political Economy*; Ralph Braibanti, Ph.D. (Syracuse), *James B. Duke Professor of Political Science*; Peter G. Fish, Ph.D. (Johns Hopkins); Ole R. Holsti, Ph.D. (Stanford), *George V. Allen Professor of Political Science*; Donald L. Horowitz, LL.M., Ph.D. (Harvard); Jerry F. Hough, Ph.D. (Harvard), *James B. Duke Professor of Political Science*; Richard H. Leach, Ph.D. (Princeton); David L. Paletz, Ph.D. (California at Los Angeles); Thomas A. Spragens, Jr., Ph.D. (Duke)

#### Associate Professors

Albert Eldridge, Ph.D. (Kentucky); Sheridan Johns III, Ph.D. (Harvard); Margaret A. McKean, Ph.D. (California at Berkeley)

#### Assistant Professors

William Bianco, Ph.D. (Rochester); David T. Canon, Ph.D. (Minnesota); Romand Coles, Ph.D. (University of Massachusetts); Robert M. Entman, Ph.D. (Yale); Michael A. Gillespie, Ph.D. (Chicago); Ruth Grant, Ph.D. (Chicago); Joseph M. Grieco, Ph.D. (Cornell); Herbert P. Kitschelt, Ph.D. (Bielefeld, West Germany); Timothy J. Lomperis, Ph.D. (Duke); Emerson M. S. Niou, Ph.D. (Univ. of Texas at Austin); Darryl Lamont Roberts, Ph.D. (Cornell); Steven Rathgeb Smith, Ph.D. (Massachusetts Inst. of Tech.)

#### Professors Emeriti

M. Margaret Ball, Ph.D. (Stanford); Frederic N. Cleaveland, Ph.D. (Princeton); Robert Taylor Cole, Ph.D. (Harvard); Kazimierz Grzybowski, S.J.D. (Harvard); Hugh M. Hall, Jr., Ph.D. (Texas); John Hamilton Hallowell, Ph.D. (Princeton)

#### Adjunct Associate Professor

Jan F. O'Barr, Ph.D. (Northwestern)

The Department of Political Science offers graduate work leading to the A.M. and Ph.D. degrees. Before being admitted to candidacy for the Ph.D. degree, an applicant must have qualified for the A.M. degree.

Instruction is designed to prepare the student for teaching and research, for government service, and for other work related to public affairs. Before undertaking graduate study in political science, a student is ordinarily expected to have completed at least 12 semester hours of course work in political science. Instruction is currently offered in the following fields: American government and politics, comparative government and politics, political theory, and international relations.

The candidate for the degree of Doctor of Philosophy in political science must take at least sixteen courses in all, including twelve in the department, and demonstrate competence in at least two general fields of the discipline as well as in a third general field or in a specialized subfield or in a field external to the department. The candidate must also demonstrate a satisfactory knowledge of statistical techniques and/or one or more foreign languages.

The terminal degree of Master of Arts, for those who do not intend to continue with doctoral studies, is awarded following successful completion of: (1) eight one-semester courses of 3 units each, at least half of which must be in political science; and (2) *either* the A.M. thesis *or* two seminar-length research papers done for Duke courses with a grade of C+ or better. Whichever of these options is selected, the student will be required to pass an oral exam. In addition, candidates for the A.M. degree must demonstrate competence in one foreign language or in statistics.

Further details on the graduate program in political science, the departmental facilities, the staff, and available financial aid may be obtained from the Director of Graduate Studies, Department of Political Science.

#### Courses of Instruction

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|--|--|
| 201S. Problems in International Security                                     | 213S. Theories of International Political Economy                |
| 203S. Issues and Problems in Politics and the Media                          | 215S. Philosophical Bases of Political Economy and Society       |
| 204S. Ethics in Political Life   | 216S. Evolution of European Marxism                              |
| 207S. American Constitutional Interpretation                                 | 218S, 219S. Political Thought in the United States               |
| 208S. Analyzing the News   | 220S. Problems in International Politics                         |
| 209. Problems in State Government and Politics                               | 221S. International Institutions and the World Political Economy |
| 211S. Current Problems and Issues in Japanese Politics                       | 222. Seminar: Modern Political Classics                          |
| 212S. Domestic Structures and Foreign Policies of Advanced Democratic States |  |

223. Ancient Political Philosophy  
 224S. Modern Political Theory  
 225. Topics in Comparative Government and Politics: Western Europe  
 226S. Theories of International Relations  
 228S. Nineteenth- and Twentieth-Century Political Philosophy  
 229S. Contemporary Theory of Liberal Democracy  
 230. Introduction to Positive Political Theory  
 231. Crisis, Choice, and Change in Advanced Democratic States  
 232. Political Economy: Theory and Applications  
 233S. Quantitative Political Analysis II  
 234S. Political Economy of Development: Theories of Change in the Third World  
 235S. Comparative Development of Islam  
 236. Statistical Analysis  
 237S. Comparative Public Policy  
 240. American Political Behavior  
 242S. Comparative Law and Policy: Ethnic Group Relations  
 243S. Political Applications of Game Theory  
 245. Ethics and Policy-Making  
 246S. Political Hypocrisy and Idealism  
 248. The Politics of the Policy Process  
 249. Comparative International Development and Technology Flow  
 251S. The American Presidency  
 253S. Comparative Government and the Study of Latin America  
 255. Political Sociology  
 256S. Arms Control and National Security Policy  
 259S. Low Intensity Conflict and the Lessons of Viet Nam  
 260S. The Tradition of Political Inquiry  
 261. Politics and the Future  
 262S. International Communism  
 263S. Methods of Political Science  
 264S. Feminist Theory and the Social Sciences  
 267S. Policy Making in International Organizations  
 270S. Fundamentals of Political Economy  
 275. The American Party System  
 277. Comparative Party Politics  
 279S. Political Protest and Collective Mobilization  
 282S. Canada  
 283S. Congressional Policy Making  
 284S. Public Policy Process in Developing Countries  
 286S. Judicial Administration  
 293. Federalism  
 299. Special Topics in Government and Politics  
 303. Seminar on Statistics  
 305. Seminar in U.S. Foreign Policy  
 306. Political Development of the U.S. Fourth Circuit Courts  
 308. Individual Research  
 309. Seminar in International Relations  
 321. Seminar in Political Theory  
 322. Topics in Early Modern Political Thought  
 324. Seminar in Comparative Politics (A)  
 325. Seminar in Comparative Politics (B)  
 326. Research Seminar in Comparative Government and Politics  
 327. Comparative Political Behavior  
 332. Seminar on Political Economy: Micro Level  
 333. Seminar on Political Economy: Macro Level  
 340. Seminar in American Politics and Institutions  
 381. Research Seminar in Latin American Government and Politics  
 390. Research Seminar in International Relations  
 397, 398. Selected Topics in Government and Politics

### Courses Currently Unscheduled

- 214S. The Politics of Scarcity  
 280S. Comparative Government and Politics: Sub-Saharan Africa  
 360. Seminar in Government and Politics in the Soviet Union

### Related Course Work in the School of Law

There may be graduate credit for course work completed in the Duke University School of Law, under regulations referred to in the larger Graduate School bulletin (see the section on academic regulations in the chapter on "Regulations" in that bulletin).

## Psychology

Professor Robert P. Erickson, Ph.D. (Brown), *Chairman*

Professor Lynn Hasher, Ph.D. (California at Berkeley), *Director of Graduate Studies*

### Professors

Irving E. Alexander, Ph.D. (Princeton); Robert C. Carson, Ph.D. (Northwestern); John D. Coie, Ph.D. (California at Berkeley); Philip R. Costanzo, Ph.D. (Florida); Irving T. Diamond, Ph.D. (Chicago), *James B. Duke Professor of Psychology*; Carl J. Erickson, Ph.D. (Rutgers); Warren G. Hall, Ph.D. (Johns Hopkins); Peter C. Holland, Ph.D. (Yale); Martin Lakin, Ph.D. (Chicago); Gregory R. Lockhead, Ph.D. (Johns Hopkins); David C. Rubin, Ph.D. (Harvard); John E. R. Staddon, Ph.D. (Harvard), *James B. Duke Professor of Psychology*; Michael A. Wallach, Ph.D. (Harvard); Cliff W. Wing, Jr., Ph.D. (Tulane)

### Associate Professors

Ruth S. Day, Ph.D. (Stanford); Carol O. Eckerman, Ph.D. (Columbia); Martha Putallaz, Ph.D. (Illinois); Susan Roth, Ph.D. (Northwestern)

### Assistant Professor

Irwin Kremen, Ph.D. (Harvard)

### Professors Emeriti

Lloyd J. Borstelmann, Ph.D. (California at Berkeley); Gregory A. Kimble, Ph.D. (Iowa); Harold Schiffman, Ph.D. (Princeton)

### Adjunct Professors

W. Edward Craighead, Ph.D. (University of Illinois- Urbana); Herbert F. Crovitz, Ph.D. (Duke); William C. Hall, Ph.D. (Duke); Susan S. Schiffman, Ph.D. (Duke); Robert J. Thompson, Jr., Ph.D. (North Dakota); Lise Wallach, Ph.D. (Kansas); Jay M. Weiss, Ph.D. (Yale)

### Adjunct Associate Professors

Gail Marsh, Ph.D. (Iowa); Scott Swartzwelder, Ph.D. (American University)

### Adjunct Assistant Professors

Ralph Cooper, Ph.D. (Rutgers); Mary Lindahl, Ph.D. (University of Chicago); John Lochman, Ph.D. (University of Connecticut)

The department offers graduate work leading to the Ph.D. degree. The areas of concentration are biological, cognitive and sensory sciences, personality, developmental, and clinical. A brochure is available from the Director of Graduate Studies which describes the program in more detail and gives information on financial assistance, facilities, and current research activities. The Psychology Department has no foreign language requirement.

### Courses of Instruction

200. Advanced Neuroscience I  
201. Advanced Neuroscience II  
203S. Sensation and Perception  
204S. Great Ideas in Psychology  
207S. Topics in Psychobiology  
210S. Cognition  
212S. Human Memory  
214S. Development of Social Interaction  
215S. Cognitive Development  
217S. Advanced Social Psychology  
219S. Physiological Foundations of Psychology  
220S. Psycholinguistics  
234S. Advanced Personality  
238S. Psychophysiology  
266S. Comparative Neurobiology  
267S. Brain Mechanisms of Behavior  
270S. A-R, U-Z. Selected Problems  
273S. Statistical Principles in Experimental Design  
284S. Feminist Theory and the Social Sciences  
289S. Psychology of Prevention  
301. Group Psychotherapy and Group Influence Processes  
302. Personality Theory  
305. Psychopathology  
307. Introduction to Theories and Methods of Mainstream Psychotherapies

309. Seminar in Learning  
310. Seminar in Perception  
318. Measurement and Methods  
329-330. Proseminar in Psychology  
335-336. Personality Assessment  
338. Ethics for Psychologists  
339. Ethics for Psychotherapists  
343-344. Clinical Practicum  
348. Psychotherapy with Children and Families  
349-350. Practicum in Psychological Research  
351. Developmental Psychopathology  
398. Graded Research  
399. Special Readings in Psychology

### Courses Currently Unscheduled

206S. Stress and Health  
230S. Social Behavior of Animals  
231S. Parent-Child Interaction  
255S. Perinatal Behavior  
286S. Biological Basis of Hearing  
323, 324. Seminar in Community Psychology  
337. Seminar in Sensory Discrimination  
352. Child Assessment  
353. Research Practicum in Prevention

## Public Policy Studies

Professor Bruce R. Kuniholm, Ph.D. (Duke), *Director*

Professor Charles T. Clotfelter, Ph.D. (Harvard), *Director of Graduate Studies*

### Professors

William Louis Ascher, Ph.D. (Yale); James D. Barber, Ph.D. (Yale); Robert D. Behn, Ph.D. (Harvard); Joel L. Fleishman, LL.M. (Yale); S. Malcolm Gillis, Ph.D. (Illinois); Donald L. Horowitz, LL.M., Ph.D. (Harvard); Jerry F. Hough, Ph.D. (Harvard); Wesley A. Magat, Ph.D. (Northwestern); George W. Pearsall, Sc.D. (Massachusetts Inst. of Tech.); David E. Price, Ph.D. (Yale)

### Associate Professors

Robert F. Conrad, Ph.D. (Wisconsin); Joseph Lipscomb, Jr., Ph.D. (Vanderbilt); John B. McConahay, Ph.D. (California at Los Angeles); Elizabeth Rapaport, Ph.D. (Case Western Reserve), J.D. (Harvard); Carol B. Stack, Ph.D. (Illinois)

### Assistant Professors

Micheline R. Malson, Ed.D. (Harvard); Frederick W. Mayer, Ph.D. (Harvard); Steven R. Smith, Ph.D. (Mass. Institute of Tech.)

### Professors of the Practice

Henry Geller, J.D. (Northwestern); Richard A. Stubbing, M.B.A. (Harvard), Ph.D. (Notre Dame); Duncan Yaggy, Ph.D. (Brandeis)



## Lecturer

Bruce L. Payne, M.A. (Yale)

The graduate program in public policy studies is offered through the Institute of Policy Sciences and Public Affairs. The objective of the program is to prepare students for jobs, particularly in the public sector, which require analytical skills and a practical understanding of the processes by which policy is made and implemented.

The A.M. degree requires two academic years and a summer internship. The first year is devoted to core courses in policy analysis, including sequences in quantitative methods, economics, political analysis, and ethics. The summer internship is arranged with a federal, state, or local agency. The second-year curriculum includes course work in public management and macroeconomics, a concentration in a substantive policy area, and a masters "memo" to be researched and written on a problem of current policy concern.

Students who are concurrently enrolled in a Ph.D. program or a professional degree program (M.D., J.D., M.B.A., M.H.A., etc.) or who have already obtained such a degree, can apply for an abbreviated version of the A.M. program. Such students are excused from most second-year requirements, so ordinarily the A.M. in public policy can be completed in one additional year. Students usually apply for a joint degree program simultaneously with their applications to the graduate departments or professional schools, or during their first or second year of advanced study.

The institute does not award a Ph.D.

More information concerning the A.M. programs can be obtained by writing the Director of Graduate Studies.

## Courses of Instruction

204S. Ethics in Political Life  
217. Microeconomics and Public Policy-Making  
218. Macroeconomic Policy  
219. The Politics of the Policy Process  
221. Decision Analysis for Public Policymakers  
222. Data Analysis for Public Policymakers  
223. Ethics and Policy-Making  
231. Quantitative Evaluation Methods  
232. Microeconomics: Policy Applications  
236, 237. Public Management I and II: Managing Public Agencies  
238S. Public Budgeting and Financial Management  
240S. Analyzing the News  
241. Reporting the American People  
245S. Leadership Tutorial  
250S. Policy, Philanthropy, and the Arts  
254. Transportation Planning and Policy Analysis  
257. United States Policy in the Middle East  
264S. Research Seminar: Topics in Public Policy I  
267S. Policy-Making in International Organizations  
268. Federal Tax Policy

270S. Humanistic Perspectives on Public Policy  
272. Resource Economics and Policy  
278. Human Service Bureaucracies  
283S. Congressional Policy-Making  
284S. Public Policy Process in Developing Countries  
286S. Economic Policy-Making in Developing Countries  
303. Public Policy Workshop I  
304.01. Public Policy Workshop II  
305.01. Public Policy Workshop III  
325S, 326S. Program in International Development Policy Sector Seminar  
327, 328. Program in International Development Policy Issue Seminar  
387. Research Tutorial in Public Policy  
388. Research Tutorial in Public Policy  
399. Special Readings in Public Policy Studies

## Courses Currently Unscheduled

256. The Economics of Health Care

## Religion

Professor Hans Hillerbrand, *Chairman*

Professor Stanley Hauerwas, Ph.D. (Yale), *Director of Graduate Studies*

### Professors

Dennis M. Campbell, Ph.D. (Duke); Elizabeth A. Clark, Ph.D. (Columbia); James L. Crenshaw, Ph.D. (Vanderbilt); Frederick Herzog, Th.D. (Princeton); Wesley A. Kort, Ph.D. (Chicago); Thomas A. Langford, Ph.D. (Duke); Bruce B. Lawrence, Ph.D. (Yale); C. Eric Lincoln, Ph.D. (Boston); George Marsden, Ph.D. (Yale); Eric M. Meyers, Ph.D. (Harvard); Robert T. Osborn, Ph.D. (Drew); D. Moody Smith, Ph.D. (Yale); Harmon L. Smith, Ph.D. (Duke); David C. Steinmetz, Th.D. (Harvard); Dan O. Via, Jr., Ph.D. (Duke); Geoffrey Wainwright, Dr. Theol. (Geneva); Orval S. Wintermute, Ph.D. (Johns Hopkins)

### Associate Professors

Lloyd R. Bailey, Ph.D. (Hebrew Union Coll., Jerusalem); Kalman Bland, Ph.D. (Brandeis); Roger J. Corless,

Ph.D. (Wisconsin); Carol L. Meyers, Ph.D. (Brandeis); Harry B. Partin, Ph.D. (Chicago); Melvin K. H. Peters, Ph.D. (Toronto); Kenneth Surin, Ph.D. (Univ. of Birmingham, England).

**Assistant Professors**

Teresa Berger, Ph.D. (Ruprecht Karl Universität); Ted A. Campbell, Ph.D. (Southern Methodist); Mary Fulker-son, Ph.D. (Vanderbilt); Susan Keefe, Ph.D. (Toronto); Dale Martin, Ph.D. (Yale); Sandra P. Robinson, Ph.D. (Chicago); William C. Turner, Ph.D. (Duke)

**Professors Emeriti**

William W. Beach, Ph.D. (Yale); David G. Bradley, Ph.D. (Yale); Stuart C. Henry, Ph.D. (Duke); Creighton Lacy, Ph.D. (Yale); Roland E. Murphy, S.T.D. (Catholic Univ. of America); William H. Poteat, Ph.D. (Duke); James Ligon Price, Jr., Ph.D. (Cambridge); Franklin W. Young, Ph.D. (Duke)

**Research Professor**

Russell Richey, Ph.D. (Princeton)

The Department of Religion offers graduate work leading to the A.M. and Ph.D. degrees. Students may major in one of seven fields: (1) Hebrew Bible and Semitic studies, (2) New Testament and Christian origins, (3) history of Christianity, (4) Christian theology and ethics, (5) history of Judaism, (6) history of religions, and (7) religion and culture. They will be expected to take courses which will contribute to an adequate understanding of their chosen fields of specialization and will be required to take two written preliminary examinations within their field of concentration.

In addition to course work in their major field, students will take such other courses in cognate fields as will contribute to the enrichment of their major studies and will be required to take one written preliminary examination in a single cognate area within the department. A minor requirement may be fulfilled by work in a cognate department, such as classical studies, history, philosophy, political science, or sociology, and will constitute the outside minor and material for a fourth written preliminary examination. There is, in addition, an oral examination conducted by the student's committee immediately subsequent to the written examinations.

The program of doctoral studies presumes a foundation in the academic study of religion. Students applying for graduate work in religion directly from an undergraduate program should have had a strong undergraduate major in religion, and will be accepted for the M.A.-Ph.D. program which presumes they will complete the M.A. as part of their progress toward the Ph.D.

The graduate program also offers an A.M. degree that is not linked to a specific Ph.D. field. Such study is intended to encourage individuals to pursue a variety of interests irrespective of whether they desire further graduate study. An A.M. concentration may be in any of the seven Ph.D. fields or in an individually designed program of study (such as Islamic studies or religion and the social sciences).

**Courses of Instruction**

- 200. Person and Work of Christ
- 201. Studies in Intertestamental Literature
- 202. Language and Literature of the Dead Sea Scrolls
- 203. Studies in American Methodism
- 204. Origen
- 205. War and the Christian Tradition
- 207, 208. Intermediate Biblical Hebrew
- 209. Old Testament Theology
- 210. Contemporary British Theology
- 211. Authority in Theology
- 213. Christian Ethics in America
- 214. Feminist Theology
- 215S. Theological Ethics
- 217. Islam in India
- 218. Religions of East Asia
- 219. Augustine
- 220. Rabbinic Hebrew
- 221. Readings in Hebrew Biblical Commentaries
- 222. John Among the Gospels
- 223A-G. Exegesis of the Hebrew Old Testament

- 225. Living Issues in New Testament Theology
- 226A-F. Exegesis of the Greek New Testament I
- 227A-E. Exegesis of the Greek New Testament II
- 228. Twentieth-Century Continental Theology
- 230S. The Meaning of Religious Language
- 231S. Seminar in Religion and Contemporary Thought
- 232S. Religion and Literature
- 233. Modern Narratives and Religious Meanings
- 234. Early Christian Asceticism
- 235. Heresy: Theological and Social Dimensions of Early Christian Dissent
- 236. Luther and the Reformation in Germany
- 237. History of the Ancient Near East
- 238. Jewish Responses to Christianity
- 239. Introduction to Middle Egyptian I
- 240. Introduction to Middle Egyptian II
- 242. Life After Death in Semitic Thought
- 243. Archaeology of Palestine in Biblical Times
- 244. The Archaeology of Palestine in Hellenistic-Roman Times
- 245. Ethics in World Religions

246. Problems in Historical Theology  
 248. The Theology of Karl Barth  
 249. The Lord's Prayer  
 250. Women in the Medieval Church  
 256. John Wesley in Controversial and Ecumenical Theology  
 257. New Testament Ethics  
 258. Coptic  
 259. Icon Theology  
 260. Life and Thought of the Wesleys  
 262. Marxist Ideology and Christian Faith  
 263. Third World Theology  
 264. The Sociology of the Black Church  
 265. The Religions of the West Africa Diaspora  
 266. Ethics and Health Care  
 267. American Puritan Thought through Edwards  
 268. Revelation and Authority in the Church  
 269. Feminist Theory and the Humanities  
 270. American Evangelicalism and Fundamentalism  
 272. The Early Medieval Church  
 273. Continental and British Roots of Evangelicalism  
 276. Baptism in the Patristic and Early Medieval Period  
 279. Understandings of the Resurrection in Contemporary Thought  
 280. The History of Religions  
 281. Phenomenology and Religion  
 282. Myth and Ritual  
 283. Islam and Modernism  
 284. The Religion and History of Islam  
 285. Introduction to the History of Religions  
 287. The Scriptures of Asia  
 288. Buddhist Thought and Practice  
 289. Theology and Contemporary Secular Understandings of Human Nature  
 290. Current Problems in Christian Social Ethics  
 291. Historical Forms of Protestant Ethics  
 292. Happiness, Virtue, and Friendship  
 293. Religious Issues in American History  
 293A. Christianity and American Thought  
 294. Christianity and the State  
 295. Religion in the American South  
 297. Philosophical and Theological Discourses on Modernity  
 298. Religious Pluralism and Christian Theologies  
 299. The Christian Understanding of Human Nature and Destiny  
 300. Systematic Theology: The Doctrine of the Trinity  
 302. Studies in the Intertestamental Literature  
 304. Aramaic  
 304A. Targumic Aramaic  
 305. The Septuagint  
 306. Language and Literature of the Dead Sea Scrolls  
 307. Syriac  
 308. Greek Patristic Texts  
 309. Hermeneutics  
 310. Readings in Judaica  
 311. Pharasaic Judaism in the First Century  
 315-316. Seminar: History of Religions  
 318. Seminar in the Greek Fathers  
 322. Nineteenth-Century European Theology  
 323A. Comparative Semitic I  
 323B. Comparative Semitic II  
 324. Readings in the History of Religion  
 325. Philosophical Theology I  
 326. Philosophical Theology II  
 329. Readings in Theology and Language  
 330. Contemporary Christologies  
 331. Eschatology  
 332. System in Theology  
 333. The Doctrine of the Trinity  
 334. Theology and Reform in the Later Middle Ages  
 336. Worlds and Texts  
 337. Theology of St. Thomas Aquinas  
 338. Calvin and the Reformed Tradition  
 340-341. Seminar in the New Testament  
 342. American Religious Biography  
 343. Readings in Ancient Near Eastern Wisdom Literature  
 346. Practical Reason and Personal Identity: Explorations in Narrative  
 347. Hebrew Narrative Art  
 350-351. Old Testament Seminar  
 352. Seminar in Christian Theology  
 353. Seminar on Text Criticism  
 360. Special Problems in Religion and Culture  
 362. Readings in Old Testament and Semitic Studies  
 363. Readings in New Testament and Christian Origins  
 364. Readings in History of Christianity  
 365. Readings in Christian Theology and Ethics  
 366. Readings in History of Religions  
 367. Readings in Religion and Culture  
 373-374. Elementary Akkadian  
 380. Existentialist Thought  
 383. Moral Theology in the Twentieth Century  
 386. Christianity in Dialogue with Other Faiths  
 387. Ethical Method  
 388. Ethics and Medicine  
 389. Christian Ethics and Contemporary Culture
- Courses Currently Unscheduled**
221. Readings in Hebrew Biblical Commentaries  
 241. Problems in Reformation Theology  
 242. Life after Death in Semitic Thought  
 247. Readings in Latin Theological Literature  
 251. Counter-Reformation and Development of Catholic Dogma  
 252. Nineteenth- and Twentieth-Century Roman Catholic Theology  
 301. Seminar in Contemporary Christian Ethics  
 311. Pharisaic Judaism in the First Century  
 312. Pauline Theology  
 313. The Apostolic Fathers  
 314. Judaism and Christianity in the New Testament  
 317. Seminar in the Greek Apologists  
 319. The Gospel According to St. Matthew in Recent Research  
 320. Theology, Power, and Justice  
 324. Readings in the History of Religion  
 327. Philosophical Method in Religious Studies  
 328. Twentieth-Century European Theology  
 335. The English Church in the Eighteenth Century  
 339. The Radical Reformation  
 344. Zwingli and the Origins of Reformed Theology  
 397. Contemporary American Theology  
 398. Colloquium on the Teaching of Religion  
 401. Colloquium in Biblical Studies



# Romance Studies

Professor Gustavo Pérez-Firmat, Ph.D. (Michigan), *Chairman*  
Associate Professor Linda Orr, Ph.D. (Yale); *Director of Graduate Studies*

## Professors

John M. Fein, Ph.D. (Harvard); Miguel Garci-Gómez, Ph.D. (Catholic Univ.); Fredric R. Jameson, Ph.D. (Yale); Valentin Mudimbe, Ph.D. (Louvain); Rafael Osuna, Ph.D. (Brown); Naomi Schor, Ph.D. (Yale), *William H. Wannamaker Professor of Romance Languages*; Philip Stewart, Ph.D. (Yale); Marcel Tetel, Ph.D. (Wisconsin); Jean-Jacques Thomas, Doctorat de 3e Cycle (Univ. of Paris)

## Associate Professors

David F. Bell III, Ph.D. (Yale); Ernesto Caserta, Ph.D. (Harvard); Alexander Hull, Ph.D. (Washington); Alice Yaeger Kaplan, Ph.D. (Yale); Elisabeth Mudimbe-Boyi, Ph.D. (Zaire)

## Assistant Professor

Valeria Finucci, Ph.D. (Illinois); Paol Keineg, Ph.D. (Brown); Kathleen A. Ross, Ph.D. (Yale); Stephanie Sieburth, Ph.D. (Princeton); Helen Solterer, Ph.D. (Toronto)

## Professors Emeriti

Thomas Cordle, Ph.D. (Yale); Wallace Fowlie, Ph.D. (Yale); Bruce W. Wardropper, Ph.D. (Pennsylvania)

## Visiting Professor

Ariel Dorfman, M.A. (University of California at Berkeley)

## Lecturer and Director of Language Instruction

Claire Tufts, Ph.D. (North Carolina)

The Department of Romance Languages offers graduate work leading to the A.M. and Ph.D. degrees in French and Spanish. Requirements for the A.M. may be completed by submission of a thesis or by passing a comprehensive examination in the major field. Related work for the A.M. and Ph.D. degrees is required in a second Romance language or in any one or two of a number of other subject areas. A reading knowledge of one foreign language which is outside the major language is required.

In order to undertake graduate study in Romance languages, the entering student should have credit for at least 18 semester hours (or equivalent) above the intermediate level in the major language.

## French

### Courses of Instruction

- 200S. Seminar in French Literature
  - 210. The Structure of French
  - 211. History of the French Language
  - 223. Semiotics for Literature
  - 240. Old French Literature
  - 248. French Literature of the Seventeenth Century
  - 251, 252. Literature of the Eighteenth Century
  - 255. French Preromantic and Romantic Poetry
  - 256. Modern Literature and History
  - 257. Problems of Identity in the Nineteenth-Century French Novel
  - 258. The Narrative of Social Crisis
  - 261. French Symbolism
  - 263. Contemporary French Theater
  - 264. Contemporary French Poetry
  - 265. French Literature of the Early Twentieth Century
  - 266. French Literature of the Mid-Twentieth Century
  - 267. Contemporary French Novel
  - 290S. Studies in a Contemporary Figure
  - 325. French Prose of the Sixteenth Century
  - 326. Topics in Renaissance Poetry
  - 391, 392. French Seminar
- Graduate Reading Course

## Italian

### Courses of Instruction

- 283. Italian Novel of the Novecento
- 284. Dante
- 285. Dante

## Spanish

### Courses of Instruction

- 200S. Seminar in Spanish Literature
- 210. History of the Spanish Language
- 241. Colonial Prose of Spanish America
- 242. Colonial Poetry and Theater of Spanish America
- 245. Modern Spanish-American Poetry
- 246. Modern Spanish-American Fiction
- 248. Studies in Spanish-American Literature
- 251. The Origins of Spanish Prose Fiction
- 253. Cervantes
- 254. Drama of the Golden Age
- 258S. Spanish Lyric Poetry before 1700
- 262. The Romantic Movement
- 266. Nineteenth-Century Prose Fiction
- 275. Modern Spanish Poetry
- 276. Modern Spanish Drama
- 277. Modern Spanish Novel
- 391, 392. Hispanic Seminar

## Romance Languages

### Courses of Instruction

- 218. The Teaching of Romance Languages
- 310. Computers for the Humanities

# Slavic Languages and Literatures

Associate Professor Thomas Lahusen, Ph.D. (Univ. of Lausanne), *Chairman*

Assistant Professor Edna Andrews, Ph.D. (Indiana Univ.), *Director of Graduate Studies*

## Assistant Professor

Stephan Pugh, Ph.D. (North Carolina at Chapel Hill)

The Department of Slavic Languages and Literatures offers graduate courses in Russian linguistics and literature and limited training in the language and literature of Poland.

Students should have sufficient preparation in the Russian language to enable them to read Russian literature in the original. Additional courses in linguistics and literature may be offered upon request.

## Courses of Instruction

### Linguistics

- 201. Topics in Comparative Slavic Linguistics
- 203. Old Church Slavonic
- 205. Semiotics and Linguistics
- 207. Semantics

### Literature

- 210. Literature and Criticism of Socialist Realism
- 250. Trends in Soviet and East European Literary Criticism
- 399. Special Readings

# Sociology

Professor Kenneth C. Land, Ph.D. (Texas), *Chairman*

Professor Gary Gereffi, Ph.D. (Yale), *Director of Graduate Studies*

## Professors

Kurt W. Back, Ph.D. (Massachusetts Inst. of Tech.), *James B. Duke Professor of Sociology*; Linda K. George, Ph.D. (Duke); Alan C. Kerckhoff, Ph.D. (Wisconsin); George L. Maddox, Jr., Ph.D. (Michigan State); George C. Myers, Ph.D. (Washington); Erdman B. Palmore, Ph.D. (Columbia); Ida H. Simpson, Ph.D. (North Carolina at Chapel Hill); Joel Smith, Ph.D. (Northwestern); Edward A. Tiryakian, Ph.D. (Harvard)

## Associate Professors

Thomas A. DiPrete, Ph.D. (Columbia); Angela O'Rand, Ph.D. (Temple); Kenneth I. Spenner, Ph.D. (Wisconsin); John Wilson, D.Phil. (Oxford)

## Assistant Professors

Art Burdos, Ph.D. (UCLA); Thomas Janoski, Ph.D. (California-Berkeley); Mark D. Reed, Ph.D. (SUNY-Albany)

## Professors Emeriti

John C. McKinney, Ph.D. (Michigan State); Jack J. Preiss, Ph.D. (Michigan State)

## Research Professor

Kenneth G. Manton, Ph.D. (Duke)

The Department of Sociology offers a challenging and rigorous program of study and research training leading to the Ph.D. degree. It also offers a special M.A. program in Comparative Development. Although graduate students working toward the Ph.D. receive a Master's degree as certain requirements are completed, the program of study is organized primarily for Ph.D. candidates. Its main components include: (1) 12-14 semester-length courses, almost exclusively in a seminar format; (2) informal research training through a close working relationship with one or more faculty members; and (3) independent research for the doctoral dissertation.

All entering students in the Ph.D. program must complete three required departmental core curriculum courses as soon as possible during the first two years of study. They include courses in sociological theory, statistical analysis, and survey research methods, and are intended to provide basic skills for advanced work. Other course work includes requirements in a primary and secondary specialization, and departmental and other electives.

Course work usually is completed in two or two-and-one-half years with research training undertaken concurrently. Preliminary examinations with written and oral components must be taken no later than the fifth semester of graduate study (third semester for those entering with an M.A.). They must be completed successfully before dissertation research can begin.

Further details concerning the sociology department and its programs may be obtained from the Director of Graduate Studies.

### Courses of Instruction

- 200S. Exile and Frontiers: Finding a Definition of Home for the Twentieth Century
- 206. Sociological Theory
- 207. Social Statistics I: Basic Concepts and Methods
- 208. Survey Research Methods
- 211A-E. Proseminars in Sociological Theory
- 212. Social Statistics II: Linear Models, Path Analysis, and Structural Equation Systems
- 213. Social Statistics III: Discrete Multivariate Models
- 214. Comparative and Historical Methods
- 215. Basic Demographic Methods and Materials
- 216. Advanced Methods of Demographic Analysis
- 217A-F. Proseminars in Social Statistics and Research Methods
- 221A-D. Proseminars in Aging and Life Course Analysis
- 222A-D. Proseminars in Comparative and Historical Sociology
- 223A-E. Proseminars in Crime, Law, and Deviance
- 224A-E. Proseminars in Populations Studies
- 225A-E. Proseminars in Organizations, Markets, and Work
- 226A-H. Proseminars in Social Institutions and Processes
- 234S. Political Economy of Development: Theories of Change in the Third World
- 255. Political Sociology
- 282S. Canada
- 298S, 299S. Seminar in Selected Topics
- 392. Individual Research in Sociology

## Institute of Statistics and Decision Sciences

Professor John F. Geweke, Ph.D. (Minnesota), *William R. Kenan Jr. Professor of Economics, Director*  
Professor Jean François Richard, Ph.D. (Louvain, Belgium), *Director of Graduate Studies*

### Professor

Robert L. Winkler, Ph.D. (Chicago), *Calvin Bryce Hoover Professor of Business Administration*

### Associate Professors

Donald Burdick, Ph.D. (Princeton); Mike West, Ph.D. (Nottingham, UK); Robert Wolpert, Ph.D. (Princeton)

### Assistant Professor

Michael Lavine, Ph.D. (Minnesota)

### Adjunct Professor

David W. Peterson, Ph.D. (Stanford)

### Adjunct Associate Professor

William E. Wilkinson, Ph.D. (North Carolina at Chapel Hill)

The Institute of Statistics and Decision Sciences offers graduate study leading to the Ph.D. degree in statistics. Distinguishing features of the institute's program are the opportunity for thorough preparation in Bayesian as well as classical statistics; research opportunities at the interface between statistics, decision sciences, and statistical computing; and close working relationships with graduate programs in several disciplines. Financial aid for all ISDS Ph.D. students is provided through University fellowships, research grants, and teaching assistantships with a time limit of four years which corresponds to expected completion time for the Ph.D. program.

Requirements for the Ph.D. degree in statistics include courses in statistics, probability, statistical computing, decision sciences and related areas; a qualifying examination at the end of the first semester and a preliminary examination at the end of the second year. The student also selects two areas of study from the following four: statistics; statistical decision science; statistics and econometrics; or statistics and computer sciences. Following completion of all course work, the student submits a dissertation written under the supervision of a thesis advisor.

### Courses of Instruction

- 203S. Senior Seminar in Statistics
- 205. Probability and Measure Theory
- 207. Probability
- 210. Statistics and Data Analysis
- 213. Introduction to Statistical Methods
- 215. Introduction to Mathematical Statistics
- 216. Generalized Linear Models
- 221. Bayesian Inference and Decision
- 226. Bayesian Analysis and Statistical Decision Theory
- 231. Behavioral Decision Theory
- 234. Choice Theory
- 242. Applied Regression Analysis
- 244. Introduction to Linear Models
- 245. Introduction to Multivariate Statistics



253. Applied Stochastic Processes  
265. Econometrics II  
266. Selected Topics in Econometric Theory  
273. Numerical Analysis I  
282. Optimization Methods  
293, 294. Special Topics in Statistics  
307, 308. Topics in Probability Theory

345. Multivariate Statistical Analysis  
356. Time Series and Forecasting  
357. Stochastic Processes  
376. Advanced Modeling and Scientific Computing  
380. Quantitative Methods and Statistics  
391, 392. Proseminar in Applied Statistics

## The University Program in Toxicology

Professor of Pathology Doyle G. Graham, M.D., Ph.D. (Duke), *Director*  
Professor Mohamed B. Abou-Donia, Ph.D. (California at Berkeley), *Deputy Director*  
James B. Duke Professor of Biochemistry Irwin Fridovich, Ph.D. (Duke), *Deputy Director*  
Associate Professor Curtis J. Richardson, Ph.D. (Tennessee), *Deputy Director*  
Professor Dolph Adams, M.D., Ph.D. (University of North Carolina at Chapel Hill), *Director of Graduate Studies*

The University Program in Toxicology seeks to produce investigators with sound training in the scientific basis for research in toxicology who will advance the science of this discipline. After broad general courses in epidemiology and statistics, pathology, and mammalian toxicology, students will be trained in one of three tracks: (1) as generalist toxicologists, with broad training in the principles and concepts of toxicology and the design of protocols for toxicological assessments; (2) as specialist toxicologists in those areas of toxicology research in which faculty members are currently productive: pulmonary toxicology, neurotoxicology, immunotoxicology, genetic toxicology (carcinogenesis), and biochemical toxicology; or (3) as ecotoxicologists with broad training in principles and concepts of both toxicology and ecology as they relate to the release, transport, exposure, accumulation, and effects of toxicants in the ecosystems.

The toxicology program faculty is comprised of members from the Departments of Anesthesiology, Biochemistry, Cell and Molecular Biology, Chemistry, Medicine, Microbiology and Immunology, Neurobiology, Pathology, Pharmacology, Zoology, the School of Forestry and Environmental Studies, and the Duke University Marine Laboratory.

Students seeking the Ph.D. in one of the participating Graduate School departments must make initial application to that department. Students who apply initially for graduate study in one of the departments may also be nominated by that department for admission to the program. Such students should list toxicology as their 'Special Field' on the application form. It is expected that most students will have a strong undergraduate preparation in mathematics and the physical and biological sciences with demonstrated excellence of performance as judged by grades in course work and letters of recommendation from former instructors.

Each student in the program will take a series of courses in toxicology as well as courses specified by his or her department. A student will be expected to choose a dissertation adviser in his or her department by the end of the first two semesters in the program, and will normally be expected to begin dissertation research during the third semester in residence. Upon satisfactorily completing all degree requirements in the program and in the department, students will be jointly recommended for the Ph.D. degree.

Further information may be obtained from the Director of the toxicology program (Department of Pathology).

## Women's Studies

Associate Professor Jean F. O'Barr, (Northwestern), *Director*  
Associate Professor Carol Meyers, (Brandeis), *Associate Director*

The Women's Studies Program provides a focal point within the university for the study of gender. Students enrolled in any of the university's departments and professional schools may participate in the program through enrollment in the courses listed below, through specialized study in independent research with any of the fifty-four faculty members associated with the program, and through pursuing an M.A. or Ph.D. thesis topic

in feminist theory. Students considering a concentration in women's studies are encouraged to consult the Director for assistance in tailoring a program of study suited to their individual professional needs. A graduate certificate in women's studies is offered to those doing IDC 211 and at least two other courses on women at the graduate level.

*SIGNS: Journal of Women in Culture and Society* is edited at Duke. Internships and work-study positions form an important part of the graduate education of students interested in feminist scholarship.

## Courses of Instruction

Interdisciplinary Course 211. History of Feminist Thought  
Interdisciplinary Course 283. Feminist Theory and the Humanities  
Interdisciplinary Course 284. Feminist Theory and the Social Sciences

## Courses on Women Offered by Departments

**Cultural Anthropology**  
215. The Anthropology of Women  
251S. American Marriage: A Cultural Approach  
272. Marxism and Feminism

### English

269. American Women Writers  
283. Feminist Theory and the Humanities  
287. Feminist Literary Theory  
321. Gender and Power in Renaissance Texts

### French

290S. Studies in a Contemporary Figure: Wittig  
391. French Prose of the 16th Century: Marguerite de Navarre

## Zoology

Professor Nicholas W. Gillham, Ph.D. (Harvard), *Chairman*

Associate Professor Mark D. Rausher, Ph.D. (Cornell), *Director of Graduate Studies*

### Professors

John D. Costlow, Jr., Ph.D. (Duke); Donald J. Fluke, Ph.D. (Yale); Richard B. Forward, Jr., Ph.D. (California at Santa Barbara); Peter H. Klopfer, Ph.D. (Yale); Daniel A. Livingstone, Ph.D. (Yale), *James B. Duke Professor of Zoology*; John G. Lundberg, Ph.D. (Michigan); David R. McClay, Ph.D. (North Carolina at Chapel Hill); R. Bruce Nicklas, Ph.D. (Columbia); H. Frederik Nijhout, Ph.D. (Harvard); John E. R. Staddon, Ph.D. (Harvard), *James B. Duke Professor of Zoology*; Vance A. Tucker, Ph.D. (California at Los Angeles); Steven Vogel, Ph.D. (Harvard); Stephen A. Wainwright, Ph.D. (California at Berkeley), *James B. Duke Professor of Zoology*; Calvin L. Ward, Ph.D. (Texas); Henry M. Wilbur, Ph.D. (Michigan)

### Associate Professors

Cathy C. Laurie, Ph.D. (Minnesota); Virginia Louise Roth, Ph.D. (Yale); John P. Sutherland, Ph.D. (California at Berkeley); Marcy K. Uyenoyama, Ph.D. (Stanford)

### Assistant Professors

Stephen Nowicki, Ph.D. (Cornell); Daniel Rittschoff, Ph.D. (University of Michigan)

### Professors Emeriti

Joseph R. Bailey, Ph.D. (Michigan); Cazlyn G. Bookhout, Ph.D. (Duke); John R. Gregg, Ph.D. (Princeton); Knut Schmidt-Nielsen, Dr.Phil. (University of Copenhagen); Karl M. Wilbur, Ph.D. (University of Pennsylvania)

### Adjunct Professor

Klaus Schmidt-Koenig, Ph.D. (Univ. of Freiburg)

### Lecturer

Mary M. Nijhout, Ph.D. (Harvard)

The Department of Zoology manages a variety of programs tailored to individual needs of students seeking the Ph.D. degree. The A.M. degree may be taken by students en route to the Ph.D., or by those who leave the doctoral program. Ordinarily, only students seeking the doctorate are admitted to the department.

### History

227-228. Recent United States History: Major Political and Social Movements  
351.40. Colloquium in Women's History

### Literature

282. Structuralism, Post-Structuralism and After  
289. Topics in Feminist Theory  
302. New Criticism in Literary Theory

### Political Science

200A. Contemporary American Feminism

### Public Policy Studies

264. Women and Justice  
278. Human Service Bureaucracies

### Religion

Christian Theology 214. Feminist Theology  
Religion 234. Early Christian Asceticism

In general, students entering the department will be equipped to pursue advanced degrees if they have completed an undergraduate major in biology along with some formal training in college-level chemistry, mathematics, physics, and foreign languages.

Nevertheless, in recognition and support of the modern trend toward interdisciplinary research, the department is prepared to accept promising students with less orthodox academic backgrounds and is ready to encourage any student wishing to undertake a program of study leading, in effect, to an interdisciplinary degree sponsored by the department.

Thus, all students are urged to search widely in both the *Bulletin of Duke University: Undergraduate Instruction* and the *Bulletin of Duke University: Graduate School* for information about the intellectual resources of the University. Special attention should be given to announcements of the Departments of Biochemistry, Biological Anthropology and Anatomy, Botany, Cell Biology, Chemistry, Geology, History, Mathematics, Microbiology and Immunology, Neurobiology, Pharmacology, Philosophy, Psychology, Sociology, and Zoology; announcements of the Schools of Engineering and Forestry and Environmental Studies should also be consulted.

### Courses of Instruction

200. Advanced Neuroscience I  
201L. Animal Behavior  
203L. Marine Ecology  
206S. Controversies in Biology  
213L. Behavioral Ecology  
216L. Limnology  
222L. Entomology  
226L. Ichthyology  
234S. Problems in the Philosophy of Biology  
237L. Systematic Biology  
244. Principles of Immunology  
245S. Radiation Biology  
247S. Photobiology  
249. Comparative Biomechanics  
250L. Physiology of Marine Animals  
259L. Laboratory in Biomechanics  
262. Biology of Parasitism  
267L. Community Ecology

269. Advanced Cell Biology  
274L. Marine Invertebrate Zoology  
278L. Invertebrate Developmental Biology  
280. Principles of Genetics  
281. DNA, Chromosomes, and Evolution  
283. Extrachromosomal Inheritance  
286. Evolutionary Mechanisms  
287S. Macroevolution  
288. Mathematical Population Genetics  
290. Modeling Biological Systems  
293L. Population Biology  
295S, 296S. Seminar  
353, 354. Research  
360, 361. Tutorials

### Courses Currently Unscheduled

233. Principles of Insect Behavior  
355, 356. Seminar

### Related Programs

The University Program in Cell and Molecular Biology. See announcement in this bulletin.

**The University Program in Genetics.** Genetics courses offered by the Department of Zoology are part of the University Program in Genetics; see announcement in this bulletin.

**The University Program in Marine Sciences.** Consult Marine Sciences in this bulletin for offerings at the Duke University Marine Laboratory.

**Program in Tropical Biology.** Fellowships are available for travel and subsistence in field-oriented programs in Latin America. Refer to Organization for Tropical Studies in this bulletin in the section on special programs.













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*Graduate School*

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The information in the bulletin applies to the academic year 1989-90 and is accurate and current, to the best of our knowledge, as of January, 1989. The University reserves the right to change programs of study, academic requirements, lecturers, teaching staffs, the announced University calendar, and other matters described in the bulletin without prior notice, in accordance with established procedures.

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The *Bulletin of Duke University*, Volume 61, includes the following titles: *The Fuqua School of Business*; *The School of Forestry and Environmental Studies*; *Marine Laboratory*; *Undergraduate Instruction*; *The Graduate School*; *The Medical Center*; *The Divinity School*; *Information for Prospective Students*; *The Graduate School* (short form); *The School of Law*; and *Information and Regulations*.

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# Calendar of the Graduate School\*

## Summer 1989†

<b>April</b>	
3	Monday—Beginning of registration for summer 1989.
<b>May</b>	
9	Tuesday—Beginning this day, summer drop/adds must be approved by the Director of Graduate Studies.
10	Wednesday—Last day for registration and payment of Term I fees without \$25 late fee (before 4:30 p.m.).
18	Thursday—Term I classes begin.
22	Monday—Drop/add for Term I ends at 4:00 p.m.
<b>June</b>	
26	Monday—Last day for registration and payment of Term II fees without \$25 late fee (before 4:30 p.m.).
30	Friday—Term I final examinations begin.
<b>July</b>	
1	Saturday—Term I final examinations end.
5	Wednesday—Term II classes begin.
7	Friday—Drop/add for Term II ends at 4:00 p.m.
<b>August</b>	
17	Thursday—Term II final examinations begin.
18	Friday—Term II final examinations end.

## Fall 1989

<b>August</b>	
21	Monday—Drop/add for graduate students who registered in April.
21	Monday—Consultations with Directors of Graduate Studies.
21	Monday—English examination for foreign students. (See chapter "Admission" for section on additional procedures for foreign students.)
22-23	Tuesday-Wednesday—Registration for all new and nonregistered returning students in the Graduate School.
25	Friday—Graduate and Professional School opening convocation.
28	Monday—Fall semester classes begin.
29	Tuesday—Late registration and drop/add from 1:00-3:00 p.m. in 127 Allen Building.
30-31	Wednesday-Thursday—Drop/add continues.
<b>September</b>	
1	Friday—Drop/add continues in 127 Allen Building. Final date for changing registration with reduction in fees. Final date for changing enrollment status from full-time to part-time.
4	Monday—Classes in session. No drop/adds taken.
5-8	Tuesday-Friday—Drop/add continues in 127 Allen Building.
8	Friday—Final date for changes in registration which involve adding courses. No late registrations taken after this date.
12-23	Monday-Friday—Drop/add continues for dropping course/seminar registration and adding equivalent units of ungraded research or residence.
23	Friday—Final date for dropping course/seminar registration and adding equivalent units of ungraded research.
<b>October</b>	
13	Friday—Fall break begins.
18	Wednesday—Classes resume.
<b>November</b>	
6-7	Monday-Tuesday—Registration for spring semester 1990.
22	Wednesday—Thanksgiving recess begins.
27	Monday—Classes resume.

\*The dates in this calendar are subject to change.

†The School of Forestry and Environmental Studies, the Fuqua School of Business, the Marine Laboratory, the Department of Health Administration, and the Department of Physical Therapy have different term lengths and/or starting dates during the summer; consult the appropriate bulletins and schedules.

## December

- 1 Friday—Final date for filing with the Graduate School office the intention to receive an advanced degree in December.
- 1 Friday—Graduate classes end.
- 2-10 Saturday-Sunday—Graduate reading period; length of 200-level course reading period is determined by the instructor.
- 10 Sunday—Founders' Day.
- 11-16 Monday-Saturday—Final examinations.
- 15 Friday—Final date for completion of requirements for an advanced degree to be dated December 1989. All final copies of examined and signed theses and dissertations must be returned to the Graduate School by this date.

## Spring 1990

### January

- 9 Tuesday—Drop/add for graduate students who registered in November.
- 9 Tuesday—English examination for foreign students. (See chapter "Admission" for section on additional procedures for foreign students.)
- 10 Wednesday—Registration for all new and nonregistered returning graduate students.
- 11 Thursday—Spring semester classes begin.
- 12 Friday—Late registration and drop/add from 1:00-3:00 p.m.
- 15-17 Monday-Wednesday—Drop/add continues. Final date for changing registration with reduction in fees. Final date for changing enrollment status from full-time to part-time.
- 18-24 Thursday-Wednesday—Drop/add continues.
- 24 Wednesday—Final date for changes in registration which involve adding courses. No late registrations taken after this date.
- 25-31 Thursday-Wednesday—Drop/add continues for dropping course/seminar registration and adding equivalent units of ungraded research.

### February

- 1 Thursday—Final date for filing with the Graduate School office the intention to receive an advanced degree in May.
- 1-2 Thursday-Friday—Drop/add continues for dropping course/seminar registration and adding equivalent units of ungraded research or residence.
- 2 Friday—Last day to drop course/seminar registration and add equivalent units of ungraded research or residence.

### March

- 9 Friday—Spring recess begins.
- 19 Monday—Classes resume.
- 30 Friday—Final date for submitting dissertation for the Ph.D. degree.

### April

- 2-3 Monday-Tuesday—Graduate registration for fall semester 1990 and beginning of registration for summer 1990.
- 16 Monday—Final date for submitting theses for master's degrees.
- 20 Friday—Graduate classes end.
- 21-29 Saturday-Sunday—Graduate reading period; length of 200-level course reading period is determined by the instructor.
- 27 Friday—Final day for completing degree requirements for an advanced degree to be awarded in May 1990. All final copies of examined and signed theses and dissertations must be returned to the Graduate School office by this date.
- 30 Monday—Final examinations begin.

### May

- 5 Monday—Final examinations end.
- 11 Friday—Commencement begins.
- 13 Sunday—Graduation exercises. Conferring of degrees.

## University Administration

### General Administration

H. Keith H. Brodie, M.D., LL.D., *President*  
Phillip A. Griffiths, Ph.D., *Provost*  
Ralph Snyderman, M.D., *Chancellor for Health Affairs and Dean of the Medical School*  
Eugene J. McDonald, LL.M., *Executive Vice-President, Administration*



William G. Anlyan, M.D., D.Sc., *Chancellor*  
Joel L. Fleishman, LL.M., *Senior Vice-President*  
J. Peyton Fuller, A.B., *Vice-President, Planning and Treasurer*  
William J. Griffith, A.B., *Vice-President for Student Affairs*  
John J. Piva, Jr., B.A., *Vice-President for Alumni Affairs and Development*  
Patricia C. Skarulis, M.A., *Vice-President for Information Systems*  
Andrew G. Wallace, M.D., *Vice-President for Health Affairs*  
John F. Adcock, B.S., *Vice-President and Corporate Controller*  
Tom A. Butters, B.A., *Vice-President and Director of Athletics*  
N. Allison Haltom, A.B., *Secretary of the University*

## Graduate School Administration

Malcolm Gillis, Ph.D., *Dean of the Graduate School*  
A. Leigh DeNeef, Ph.D., *Associate Dean*  
Donna Lee Giles, A.B., *Assistant Dean*  
Jacqueline Looney, Ph.D., *Assistant Dean*  
Katharine Pfeiffer, M.A., *Assistant Dean*  
Aleane G. Webb, *Assistant Dean*

## Executive Committee of the Graduate Faculty

Dean Malcolm Gillis  
Associate Dean Leigh DeNeef

William Ascher  
Robert Ashton  
Steven Baldwin  
Jeffrey R. Dawson  
Oliver Ferguson  
Alfred Goshaw  
Lynn Hasher  
Robert Hochmuth  
Peter Lange  
Bruce Lawrence  
Annabel Patterson  
George Pearsall  
Salvatore Pizzo  
Richard Searles  
Kathleen Smith  
Larry Todd

## Graduate School Faculty

(As of November 1, 1988.)

The date denotes the first year of service at Duke University.

Mohamed Bahie Abou-Donia (1975), Ph.D., *Professor of Pharmacology*  
Dolph O. Adams (1972), M.D., Ph.D., *Professor of Pathology and Associate Professor of Immunology*  
John H. Aldrich (1987), Ph.D., *Professor of Political Science*  
Irving E. Alexander (1963), Ph.D., *Professor of Psychology*  
Dimitri Alexandrou (1987), Ph.D., *Assistant Professor of Electrical Engineering*  
Ralph J. Alig (1986), Ph.D., *Adjunct Assistant Professor of Forest Economics*  
William K. Allard (1975), Ph.D., *Professor of Mathematics*  
A. Tito Alt (1961-65; 1967), Ph.D., *Associate Professor of Germanic Languages and Literature*  
D. Bernard Amos (1962), M.D., *James B. Duke Professor of Immunology*  
Carl L. Anderson (1955), Ph.D., *Professor of English*  
Nels C. Anderson (1966), Ph.D., *Associate Professor of Cell Biology*  
Page A. W. Anderson (1973), M.D., *Assistant Professor of Cell Biology*  
Edna Andrews (1984), Ph.D., *Assistant Professor of Slavic Languages and Literatures*  
Robert Anholt (1986), Ph.D., *Assistant Professor of Neurobiology*  
Janis Antonovics (1970), Ph.D., *James J. Wolfe Professor of Botany*  
James W. Applewhite (1971), Ph.D., *Associate Professor of English*  
Mahadev L. Apte (1965), Ph.D., *Professor of Cultural Anthropology*  
Yair Argon (1984), Ph.D., *Assistant Professor of Immunology*  
Edward M. Arnett (1980), Ph.D., *R. J. Reynolds Professor of Chemistry*  
William Louis Ascher (1984), Ph.D., *Professor of Public Policy Studies and Professor of Political Science*  
Alison Hubbard Ashton (1986), Ph.D., *Associate Professor of Business Administration*

Robert H. Ashton (1986), Ph.D., *Professor of Business Administration*  
 Kurt W. Back (1959), Ph.D., *James B. Duke Professor of Sociology*  
 Lloyd Richard Bailey (1971), Ph.D., *Associate Professor of Religion, Old Testament*  
 Paul A. Baker (1981), Ph.D., *Associate Professor of Geology*  
 Andrew E. Balber (1983), Ph.D., *Associate Medical Research Professor of Immunology*  
 Roper C. Baldwin (1970), Ph.D., *Professor of Chemistry*  
 Helmy Hamdollah Baligh (1967), Ph.D., *Professor of Business Administration*  
 Robert H. Ballantyne (1962), Ed.D., *Associate Professor of Education*  
 James David Barber (1972), Ph.D., *James B. Duke Professor of Political Science and Professor of Public Policy Studies*  
 Roger C. Barr (1969), Ph.D., *Professor of Biomedical Engineering*  
 Elizabeth C. Bartlett (1982), Ph.D., *Assistant Professor of Music*  
 Robert Charles Bartlett (1976), M.A., *Professor of Physical Therapy*  
 Jorge Valls Bartolome (1978), Ph.D., *Assistant Medical Research Professor of Pharmacology*  
 Deepak Bastia (1979), Ph.D., *Professor of Microbiology*  
 Robert H. Bates (1985), Ph.D., *Henry R. Luce Professor of Political Science*  
 Joseph Battle (1970), Ph.D., *Associate Professor of Business Administration*  
 James R. Baumgardner (1985), Ph.D., *Assistant Professor of Economics*  
 J. Thomas Beale (1983), Ph.D., *Professor of Mathematics*  
 Hie Ping Beall (1975), Ph.D., *Assistant Medical Research Professor of Cell Biology*  
 Michael Been (1987), Ph.D., *Assistant Professor of Biochemistry*  
 Robert D. Behn (1973), Ph.D., *Associate Professor of Public Policy Studies*  
 Robert Paul Behringer (1982), Ph.D., *Associate Professor of Physics*  
 Adrian Bejan (1984), Ph.D., *Professor of Mechanical Engineering and Materials Science*  
 Joanne M. Bell (1985), Ph.D., *Assistant Medical Research Professor of Pharmacology*  
 Robert M. Bell (1972), Ph.D., *James B. Duke Professor of Biochemistry*  
 Peter Brian Bennett (1972), Ph.D., D.Sc., *Associate Professor of Neurobiology*  
 Vann Bennett (1987), Ph.D., *Professor of Biochemistry*  
 Teresa Berger (1987), Ph.D., *Assistant Professor of Religion, Ecumenical Theology*  
 James R. Bettman (1982), Ph.D., *Burlington Industries Professor of Business Administration*  
 William T. Bianco (1987), Ph.D., *Assistant Professor of Political Science*  
 L. C. Biedenharn, Jr. (1961), Ph.D., *Professor of Physics*  
 Alan Biermann (1974), Ph.D., *Professor of Computer Science*  
 Darell D. Bigner (1972), M.D., Ph.D., *Professor of Pathology*  
 Sandra H. Bigner (1977), M.D., *Professor of Pathology*  
 Edward George Bilpuch (1962), Ph.D., *Professor of Physics*  
 Mrinmay Biswas (1983), Ph.D., *Associate Professor of Civil Engineering*  
 Perry J. Blackshear (1985), M.D., Ph.D., *Assistant Professor of Biochemistry*  
 Kalman P. Bland (1973), Ph.D., *Associate Professor of Religion*  
 Donald B. Bliss (1985), Ph.D., *Associate Professor of Mechanical Engineering and Materials Science*  
 J. J. Blum (1962), Ph.D., *James B. Duke Professor of Cell Biology*  
 John A. Board, Jr. (1986), Ph.D., *Assistant Professor of Electrical Engineering and Assistant Professor of Computer Science*  
 Mary T. Boatwright (1979), Ph.D., *Associate Professor of Classical Studies*  
 Dani P. Bolognesi (1971), Ph.D., *Professor of Virology*  
 Celia Bonaventura (1972), Ph.D., *Associate Professor of Cell Biology*  
 Joseph Bonaventura (1972), Ph.D., *Associate Professor of Cell Biology*  
 James F. Bonk (1959), Ph.D., *Professor of Chemistry*  
 Frank Borchardt (1971), Ph.D., *Associate Professor of Germanic Languages and Literature*  
 Edward H. Bossen (1972), M.D., *Professor of Pathology*  
 Alan E. Boudreau (1989), Ph.D., *Assistant Professor of Geology*  
 William F. Boulding (1984), Ph.D., *Assistant Professor of Business Administration*  
 Stephen G. Boyce (1981), Ph.D., *Adjunct Professor of Natural Resources*  
 John E. Boynton (1968), Ph.D., *Professor of Botany*  
 William D. Bradford (1966), M.D., *Professor of Pathology*  
 Ralph Braibanti (1953), Ph.D., *James B. Duke Professor of Political Science*  
 Eleanor F. Branch (1972), Ph.D., *Associate Professor of Physical Therapy*  
 Robert N. Brandon (1979), Ph.D., *Andrew W. Mellon Associate Professor of Philosophy*  
 Philip L. Brock (1982), Ph.D., *Assistant Professor of Economics*  
 Arnold Ralph Brody (1978), Ph.D., *Adjunct Assistant Professor of Pathology*  
 Caroline A. Bruzelius (1981), Ph.D., *Andrew W. Mellon Associate Professor of Art History*  
 Robert Bryant (1987), Ph.D., *Arts and Sciences Professor of Mathematics*  
 James D. Bryers (1985), Ph.D., *Associate Professor of Civil and Environmental Engineering and Associate Professor of Biochemical Engineering*  
 C. Edward Buckley III (1963), M.D., *Assistant Professor of Microbiology and Immunology*  
 Rebecca Buckley (1968), M.D., *Professor of Immunology*  
 Louis J. Budd (1952), Ph.D., *James B. Duke Professor of English*  
 M. Vickers Burdett (1977), Ph.D., *Assistant Medical Research Professor of Microbiology*

Donald S. Burdick (1962), Ph.D., *Associate Professor of Mathematics and Associate Professor of Biomedical Engineering*  
 Peter C. Burger (1973), M.D., *Professor of Pathology*  
 Peter Burian (1968), Ph.D., *Associate Professor of Classical Studies*  
 Marian Burke (1982), Ph.D., *Associate Professor of Business Administration*  
 Richard M. Burton (1970), D.B.A., *Professor of Business Administration*  
 Jane Butt (1985), Ph.D., *Assistant Professor of Business Administration*  
 Ronald Richard Butters (1967), Ph.D., *Associate Professor of English*  
 Gale H. Buzzard (1957), Ph.D., *Assistant Professor of Mechanical Engineering*  
 Nancy E. Cahill (1987), J.D., *Adjunct Assistant Professor of Health Administration*  
 Clark R. Cahow (1960), Ph.D., *Arts and Sciences Professor of History*  
 Dennis M. Campbell (1982), Ph.D., *Professor of Religion, Theology*  
 Ted Allen Campbell (1986), Ph.D., *Assistant Professor of Religion, Church History*  
 Enrico Mario Camporesi (1977), M.D., *Assistant Professor of Cell Biology*  
 David T. Canon (1987), Ph.D., *Assistant Professor of Political Science*  
 Nell B. Cant (1978), Ph.D., *Associate Professor of Neurobiology*  
 Peter F. Carbone (1966), Ed.D., *Associate Professor of Education*  
 Marc Caron (1983), Ph.D., *Associate Professor of Cell Biology*  
 Robert C. Carson (1960), Ph.D., *Professor of Psychology*  
 Reginald D. Carter (1971), Ph.D., *Adjunct Assistant Professor of Cell Biology*  
 Matt Cartmill (1969), Ph.D., *Professor of Biological Anthropology and Anatomy and Professor of Anthropology*  
 Ernesto Caserta (1970), Ph.D., *Associate Professor of Romance Languages*  
 H. Craig Casey, Jr. (1979), Ph.D., *Professor of Electrical Engineering*  
 John H. Casseday (1972), Ph.D., *Associate Medical Research Professor of Psychology*  
 David Castriota (1985), Ph.D., *Assistant Professor of Art History*  
 John Cell (1962), Ph.D., *Professor of History*  
 Jack B. Chaddock (1966), Sc.D., *Professor of Mechanical Engineering*  
 William Chafe (1971), Ph.D., *Alice Baldwin Professor of History*  
 Jagdish Chandra (1974), Ph.D., *Adjunct Professor of Mathematics*  
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 Robert S. Cherry (1987), Ph.D., *Assistant Professor of Mechanical Engineering and Materials Science*  
 Donald B. Chesnut (1965), Ph.D., *Professor of Chemistry*  
 Norman L. Christensen, Jr. (1973), Ph.D., *Professor of Botany and Professor of Forestry*  
 Mikael Ciftan (1967), Ph.D., *Adjunct Professor of Physics*  
 Elizabeth Ann Clark (1982), Ph.D., *Professor of Religion*  
 Howard G. Clark (1968), Ph.D., *Professor of Biomedical Engineering and Professor of Materials Science*  
 Charles T. Clotfelter (1979), Ph.D., *Professor of Public Policy Studies and Professor of Economics*  
 John MacKenzie Clum (1966), Ph.D., *Associate Professor of English*  
 A. W. Coats (1984), Ph.D., *Research Professor of Economics*  
 Franklin H. Cocks (1972), Sc.D., *Professor of Materials Science*  
 Kalman J. Cohen (1974), Ph.D., *Distinguished Bank Research Professor and Professor of Business Administration*  
 John D. Coie (1968), Ph.D., *Professor of Psychology*  
 Romand Coles (1988), Ph.D., *Visiting Assistant Professor of Political Science*  
 Joel Colton (1947), Ph.D., *Professor of History*  
 William K. Condrell (1982), J.D., *Adjunct Professor of Forestry*  
 Philip J. Cook (1973), Ph.D., *Professor of Public Policy Studies and Professor of Economics*  
 Joseph M. Corless (1972), M.D., Ph.D., *Associate Professor of Cell Biology and Associate Professor of Neurobiology*  
 Roger J. Corless (1970), Ph.D., *Associate Professor of Religion*  
 Ronald B. Corley (1977), Ph.D., *Associate Professor of Immunology*  
 Bruce Hayward Corliss (1984), Ph.D., *Associate Professor of Geology*  
 Philip R. Costanzo (1968), Ph.D., *Professor of Psychology*  
 John D. Costlow, Jr. (1959), Ph.D., *Professor of Zoology*  
 William M. Coughran (1985), Ph.D., *Adjunct Associate Professor of Computer Science*  
 Sheila J. Counce (1968), Ph.D., *Professor of Cell Biology*  
 Barbara J. Crain (1986), M.D., Ph.D., *Assistant Professor of Neurobiology and Assistant Professor of Pathology*  
 James D. Crapo (1986), Ph.D., *Associate Professor of Pathology*  
 James Crenshaw (1987), Ph.D., *Professor of Religion, Old Testament*  
 Peter Cresswell (1973), Ph.D., *Professor of Immunology*  
 Herbert F. Crovitz (1963), Ph.D., *Adjunct Professor of Psychology*  
 Alvin L. Crumbliss (1970), Ph.D., *Professor of Chemistry*  
 Chicita F. Culberson (1971), Ph.D., *Adjunct Professor of Botany*  
 William Louis Culberson (1955), Ph.D., *Hugo L. Blomquist Professor of Botany*  
 Ronald Y. Cusson (1970), Ph.D., *Professor of Physics*  
 Frederick Daniels (1986), Ph.D., *Assistant Professor of Biomedical Engineering*  
 Richard L. Daniels (1986), Ph.D., *Assistant Professor of Business Administration*  
 David G. Davies (1961), Ph.D., *Professor of Economics*  
 James Norman Davis (1972), M.D., *Professor of Pharmacology*



Lucy T. Davis (1969), Ed.D., *Associate Professor of Education*  
 Richard L. Davis (1983), Ph.D., *Associate Professor of History*  
 Jeffrey R. Dawson (1972), Ph.D., *Associate Professor of Immunology*  
 Ruth S. Day (1978), Ph.D., *Associate Professor of Psychology*  
 David C. Dellinger (1986), Ph.D., *Associate Professor of Business Administration*  
 Frank C. De Lucia (1969), Ph.D., *Professor of Physics*  
 Neil Barry de Marchi (1971-80; 1983), Ph.D., *Professor of Economics*  
 A. Leigh DeNeef (1969), Ph.D., *Professor of English*  
 Vincent W. Dennis (1973), M.D., *Assistant Professor of Cell Biology*  
 Irving T. Diamond (1958), Ph.D., *James B. Duke Professor of Psychology and Professor of Neurobiology*  
 Joseph Di Bona (1967), Ph.D., *Associate Professor of Education*  
 Robert Dickens (1949), Ph.D., *Professor of Business Administration*  
 Michael P. Dieter (1986), Ph.D., *Adjunct Professor of Ecotoxicology*  
 Richard T. Di Giulio (1982), Ph.D., *Assistant Professor of Ecotoxicology*  
 Thomas A. DiPrete (1988), Ph.D., *Associate Professor of Sociology*  
 Arif Dirlik (1971), Ph.D., *Associate Professor of History*  
 Apostolos Dollas (1986), Ph.D., *Assistant Professor of Electrical Engineering*  
 Virginia R. Dominguez (1979), Ph.D., *Associate Professor of Cultural Anthropology*  
 William J. Donelan (1982), M.S., *Adjunct Associate Professor of Health Administration*  
 Earl H. Dowell (1983), Sc.D., *Professor of Mechanical Engineering*  
 Joanne Bechta Dugan (1985), Ph.D., *Associate Professor of Computer Science and Research Assistant Professor of Electrical Engineering*  
 Pamela W. Duncan (1979), M.A.C.T., *Assistant Professor of Physical Therapy*  
 Robert F. Durden (1952), Ph.D., *Professor of History*  
 Dan Durning (1985), Ph.D., *Assistant Professor of Public Policy Studies*  
 George F. Dutrow (1976), Ph.D., *Professor of Forestry*  
 Carol O. Eckerman (1972), Ph.D., *Associate Professor of Psychology*  
 David M. Eddy (1981), M.D., Ph.D., *Professor of Public Policy Studies and Professor of Community and Family Medicine*  
 Julie A. Edell (1981), Ph.D., *Associate Professor of Business Administration*  
 Leah Edelstein (1984), Ph.D., *Lecturer in Mathematics*  
 Eric L. Effmann (1977), M.D., *Associate Professor of Cell Biology*  
 Albert Eldridge (1970), Ph.D., *Associate Professor of Political Science*  
 Everett H. Ellinwood, Jr. (1966), M.D., *Professor of Pharmacology*  
 Carla S. Ellis (1986), Ph.D., *Associate Professor of Computer Science*  
 John L. Ellis (1986), Ph.D., *Research Associate Professor of Computer Science*  
 Sharyn Endow (1978), Ph.D., *Associate Professor of Microbiology and Immunology*  
 Peter C. English (1978), M.D., Ph.D., *Associate Professor of History*  
 Robert M. Entman (1980), Ph.D., *Assistant Professor of Public Policy Studies and Assistant Professor of Political Science*  
 Carl J. Erickson (1966), Ph.D., *Professor of Psychology*  
 Harold P. Erickson (1970), Ph.D., *Professor of Cell Biology*  
 Robert P. Erickson (1961), Ph.D., *Professor of Psychology and Associate Professor of Neurobiology*  
 Lawrence E. Evans (1963), Ph.D., *Professor of Physics*  
 Janet J. Ewald (1984), Ph.D., *Assistant Professor of History*  
 Richard B. Fair (1981), Ph.D., *Professor of Electrical Engineering*  
 Henry A. Fairbank (1962), Ph.D., *Professor of Physics*  
 David J. Falcone (1975), M.H.A., Ph.D., *Associate Professor of Health Administration*  
 Bruce C. Faust (1987), Ph.D., *Research Assistant Professor of Forestry and Environmental Studies*  
 John Morton Fein (1950), Ph.D., *Professor of Romance Languages*  
 Michael T. Ferejohn (1983), Ph.D., *Assistant Professor of Philosophy*  
 Oliver W. Ferguson (1957), Ph.D., *Professor of English*  
 Thomas J. Ferraro (1988), Ph.D., *Professor of English*  
 Bernard F. Fetter (1951), M.D., *Professor of Pathology*  
 Carol Fierke (1987), Ph.D., *Assistant Professor of Biochemistry*  
 Olivera J. Finn (1982), Ph.D., *Assistant Professor of Immunology*  
 Valeria Finucci (1986), Ph.D., *Assistant Professor of Romance Languages*  
 Peter G. Fish (1969), Ph.D., *Professor of Political Science*  
 Stanley Fish (1985), Ph.D., *Arts and Sciences Professor of English*  
 David Fitzpatrick (1983), Ph.D., *Assistant Professor of Neurobiology and Adjunct Research Professor of Psychology*  
 Joel Fleishman (1971), LL.M., *Professor of Public Policy Studies*  
 Donald J. Fluke (1958), Ph.D., *Professor of Zoology*  
 John D. Forsyth (1978), D.B.A., *Professor of Business Administration*  
 Lloyd R. Fortney (1964), Ph.D., *Professor of Physics*  
 Richard B. Forward (1971), Ph.D., *Professor of Zoology*  
 F. Douglas Foster (1986), Ph.D., *Assistant Professor of Business Administration*  
 Richard G. Fox (1968), Ph.D., *Professor of Cultural Anthropology*  
 Jennifer Francis (1987), Ph.D., *Assistant Professor of Business Administration*

Bertram O. Fraser-Reid (1983), Ph.D., *James B. Duke Professor of Chemistry*  
 Karen Z. Frenzel (1986), Ph.D., *Research Assistant Professor of Electrical Engineering*  
 Irwin Fridovich (1958), Ph.D., *James B. Duke Professor of Biochemistry*  
 Mary Fulkerson (1987), Ph.D., *Assistant Professor of Religion, Theology*  
 Jane Marie Gaines (1982), Ph.D., *Assistant Professor of English*  
 Thomas M. Gallie, Jr. (1954-55; 1956), Ph.D., *Professor of Computer Science*  
 Miguel Garcí-Gómez (1973), Ph.D., *Professor of Romance Languages*  
 Carl L. Gardner (1986), Ph.D., *Assistant Professor of Computer Science and Assistant Professor of Mathematics*  
 Grant W. Gardner (1981), Ph.D., *Associate Professor of Business Administration*  
 Devendra P. Garg (1972), Ph.D., *Professor of Mechanical Engineering*  
 David Barry Gaspar (1983), Ph.D., *Professor of History*  
 Raymond Gavins (1970), Ph.D., *Associate Professor of History*  
 Linda K. George (1976), Ph.D., *Professor of Sociology*  
 Rhett Truesdale George, Jr. (1957), Ph.D., *Assistant Professor of Electrical Engineering*  
 John G. Georgiadis (1987), Ph.D., *Assistant Professor of Mechanical Engineering and Materials Science*  
 Gerald E. Gerber (1962), Ph.D., *Associate Professor of English*  
 Gary Gereffi (1980), Ph.D., *Associate Professor of Sociology*  
 John F. Geweke (1983), Ph.D., *Kenan Professor of Economics*  
 Michael A. Gillespie (1983), Ph.D., *Assistant Professor of Political Science*  
 Nicholas W. Gillham (1968), Ph.D., *James B. Duke Professor of Zoology*  
 Bryan Gilliam (1986), Ph.D., *Assistant Professor of Music*  
 Stephen Malcolm Gillis (1984), Ph.D., *Professor of Public Policy Studies and Professor of Economics*  
 Kenneth E. Glander (1975), Ph.D., *Associate Professor of Biological Anthropology and Anatomy*  
 Robert F. Gleckner (1978), Ph.D., *Professor of English*  
 Martin P. Golding (1976), Ph.D., *Professor of Philosophy*  
 Craufurd Goodwin (1962), Ph.D., *James B. Duke Professor of Economics*  
 Lawrence C. Goodwyn (1971), Ph.D., *Associate Professor of History*  
 George D. Gopen (1985), Ph.D., *Associate Professor of English*  
 Andrew Gordon (1985), Ph.D., *Associate Professor of History*  
 Ulrich M. Gösele (1984), Ph.D., *Professor of Mechanical Engineering*  
 Alfred T. Goshaw (1973), Ph.D., *Professor of Physics*  
 Henry G. Grabowski (1972), Ph.D., *Professor of Economics*  
 Daniel A. Graham (1969), Ph.D., *Professor of Economics*  
 Doyle G. Graham (1970), M.D., Ph.D., *Professor of Pathology*  
 Ruth W. Grant (1987), Ph.D., *Assistant Professor of Political Science*  
 Monica Green (1987), Ph.D., *Assistant Professor of History*  
 Ronald C. Greene (1958), Ph.D., *Associate Professor of Biochemistry*  
 Warner Craig Greene (1987), M.D., Ph.D., *Associate Professor of Microbiology and Immunology*  
 Joseph C. Greenfield (1962), M.D., *Associate Professor of Cell Biology*  
 Arno L. Greenleaf (1977), Ph.D., *Associate Professor of Biochemistry*  
 Henry S. Greenside (1986), *Associate Professor of Computer Science and Associate Professor of Physics*  
 Christopher Gresov (1987), Ph.D., *Assistant Professor of Business Administration*  
 Joseph M. Grieco (1982), Ph.D., *Assistant Professor of Political Science*  
 Phillip A. Griffiths (1983), Ph.D., *James B. Duke Professor of Mathematics*  
 Samson R. Gross (1960), Ph.D., *Professor of Biochemistry*  
 Bobby D. Guenther (1980), Ph.D., *Adjunct Professor of Physics*  
 John W. Gutknecht (1969), Ph.D., *Professor of Cell Biology*  
 Janet Gwyer (1987), Ph.D., *Assistant Professor of Physical Therapy*  
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 Herbert Hacker, Jr. (1965), Ph.D., *Associate Professor of Electrical Engineering*  
 Peter K. Haff (1988), Ph.D., *Professor of Civil Engineering*  
 Warren G. Hall (1982), Ph.D., *Professor of Psychology*  
 William C. Hall (1970), Ph.D., *Professor of Neurobiology and Adjunct Professor of Psychology*  
 William E. Hammond (1968), Ph.D., *Professor of Biomedical Engineering*  
 Moo-Young Han (1967), Ph.D., *Professor of Physics*  
 John H. L. Hansen (1988), Ph.D., *Assistant Professor of Electrical Engineering*  
 Stuart Handwerker (1971), M.D., *Assistant Professor of Cell Biology*  
 Charles Morgan Harman (1961), Ph.D., *Professor of Mechanical Engineering*  
 Campbell Harvey (1986), Ph.D., *Assistant Professor of Business Administration*  
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 Diane L. Hatchell (1983), Ph.D., *Professor of Cell Biology*  
 Stanley Hauerwas (1984), Ph.D., *Professor of Religion, Theological Ethics*  
 Thomas M. Havrilesky (1969), Ph.D., *Professor of Economics*  
 Barton Ford Haynes (1980), M.D., *Associate Professor of Immunology*  
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 Robert William Henkens (1968), Ph.D., *Associate Professor of Chemistry*  
 Eric Herbst (1980), Ph.D., *Professor of Physics*  
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 Robert Hill (1986), Ph.D., *Assistant Professor of Music*  
 Robert L. Hill (1961), Ph.D., *James B. Duke Professor of Biochemistry*  
 Hans Hillerbrand (1959-1970; 1988), Ph.D., *Professor of Religion*  
 Michael Lee Hines (1978), Ph.D., *Assistant Medical Research Professor of Neurobiology*  
 Robert M. Hochmuth (1978), Ph.D., *Professor of Mechanical Engineering and Materials Science and Professor of Biomedical Engineering*  
 Richard Earl Hodel (1965), Ph.D., *Associate Professor of Mathematics*  
 Peter C. Holland (1986), Ph.D., *Associate Professor of Psychology*  
 Mark A. Holliday (1986), Ph.D., *Assistant Professor of Computer Science*  
 Edward V. Holmes (1986), M.D., *Associate Professor of Biochemistry*  
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 Jerry F. Hough (1973), Ph.D., *James B. Duke Professor of Political Science and Professor of Public Policy Studies*  
 Calvin R. Howell (1984), Ph.D., *Assistant Professor of Physics*  
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 Joel C. Huber (1978), Ph.D., *Associate Professor of Business Administration*  
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 William F. Hyde (1979), Ph.D., *Adjunct Professor of Forestry and Environmental Studies*  
 William L. Hylander (1971), Ph.D., *Professor of Biological Anthropology and Anatomy*  
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 B. Jon Jaeger (1972), Ph.D., *Professor of Health Administration*  
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 Robert B. Jennings (1975), M.D., *James B. Duke Professor of Pathology*  
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 Frans F. Jöbsis (1964), Ph.D., *Professor of Cell Biology*  
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 Kenneth C. Land (1985), Ph.D., *Professor of Sociology*  
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 Bruce B. Lawrence (1971), Ph.D., *Professor of Religion*  
 Harold E. Layton (1988), Ph.D., *Assistant Professor of Mathematics*  
 Richard H. Leach (1955), Ph.D., *Professor of Political Science*  
 Robert Lefkowitz (1973), M.D., *James B. Duke Professor of Biochemistry*  
 Ann LeFurgey (1980), Ph.D., *Assistant Professor of Cell Biology*  
 Frank Lentricchia (1984), Ph.D., *Professor of English*  
 Warren Lerner (1961), Ph.D. *Professor of History*  
 Steven Levine (1988), Ph.D., *Visiting Assistant Professor of Political Science*  
 Arie Y. Lewin (1974), Ph.D., *Professor of Business Administration*  
 Darrell Vincent Lewis (1978), M.D., *Assistant Professor of Neurobiology*  
 Melvyn Lieberman (1968), Ph.D., *Professor of Cell Biology*  
 Chia-Sheng Lin (1981), Ph.D., *Adjunct Assistant Professor of Neurobiology*  
 C. Eric Lincoln (1976), Ph.D., *Professor of Sociology of Religion*  
 Frederick W. Lindahl (1985), Ph.D., *Assistant Professor of Economics*  
 Elwood A. Linney (1984), Ph.D., *Associate Professor of Microbiology and Immunology*  
 Joseph Lipscomb, Jr. (1974), Ph.D., *Associate Professor of Public Policy Studies*  
 Daniel A. Livingstone (1956), Ph.D., *James B. Duke Professor of Zoology*  
 John E. Lochman (1984), Ph.D., *Adjunct Assistant Professor of Psychology*  
 Charles H. Lochmüller (1969), Ph.D., *Professor of Chemistry and Professor of Biochemical Engineering*  
 Gregory R. Lockhead (1965), Ph.D., *Professor of Psychology*  
 Timothy J. Lomperis (1984), Ph.D., *Assistant Professor of Political Science*  
 Donald W. Loveland (1973), Ph.D., *Professor of Computer Science*  
 John Charles Lucchesi (1980), Ph.D., *Adjunct Professor in the Genetics Program*  
 John G. Lundberg (1970), Ph.D., *Associate Professor of Zoology*  
 John M. McCann (1978), Ph.D., *Associate Professor of Business Administration*  
 Kevin F. McCardle (1985), Ph.D., *Assistant Professor of Business Administration*  
 Kenneth S. McCarty (1959), Ph.D., *Professor of Biochemistry*  
 Kenneth Scott McCarty, Jr. (1976), M.D., Ph.D., *Associate Professor of Pathology*  
 David R. McClay (1973), Ph.D., *Professor of Zoology and Professor of Immunology*

John B. McConahay (1974), Ph.D., *Associate Professor of Public Policy Studies*  
 James H. McElhaney (1973), Ph.D., *Professor of Biomedical Engineering*  
 Marjorie McElroy (1970), Ph.D., *Professor of Economics*  
 Linda McGown (1987), Ph.D., *Associate Professor of Chemistry*  
 Thomas J. McIntosh (1977), Ph.D., *Associate Professor of Cell Biology*  
 Margaret A. McKean (1974), Ph.D., *Associate Professor of Political Science*  
 Thomas J. McManus (1961), M.D., *Associate Professor of Cell Biology*  
 James O. McNamara (1973), M.D., *Associate Professor of Pharmacology*  
 Andrew T. McPhail (1968), Ph.D., *Professor of Chemistry*  
 Richard A. MacPhail (1984), Ph.D., *Assistant Professor of Chemistry*  
 George L. Maddox, Jr. (1960), Ph.D., *Professor of Sociology*  
 Wesley A. Magat (1974), Ph.D., *Associate Professor in Fuqua School of Business and Associate Professor of Public Policy Studies*  
 Lynn A. Maguire (1982), Ph.D., *Assistant Professor of Resource Ecology*  
 Edward P. Mahoney (1965), Ph.D., *Professor of Philosophy*  
 Terry Malone (1987), Ed.D., *Associate Professor of Physical Therapy*  
 Lazaro J. Mandel (1972), Ph.D., *Professor of Cell Biology*  
 Kenneth G. Manton (1977), Ph.D., *Research Professor of Demographic Studies*  
 Luigi Manzetti (1988), Ph.D., *Visiting Assistant Professor of Political Science*  
 Peter N. Marinos (1968), Ph.D., *Professor of Electrical Engineering and Professor of Computer Science*  
 George Marsden (1986), Ph.D., *Professor of Religion, History of Christianity in America*  
 Gail R. Marsh (1969), Ph.D., *Adjunct Assistant Professor of Psychology*  
 Robert C. Marshall (1983), Ph.D., *Associate Professor of Economics*  
 Dale Martin (1988), Ph.D., *Assistant Professor of Religion*  
 Hisham Z. Massoud (1983), Ph.D., *Associate Professor of Electrical Engineering*  
 Seymour Mauskopf (1964), Ph.D., *Professor of History*  
 Mary E. Mayesky (1979), Ph.D., *Adjunct Assistant Professor of Education*  
 Joseph B. Mazzola (1984), Ph.D., *Associate Professor of Business Administration*  
 Miguel A. Medina, Jr. (1976), Ph.D., *Associate Professor of Civil and Environmental Engineering*  
 Elgin W. Mellow, Jr. (1965), Ph.D., *Associate Professor of English*  
 Robert J. Melosh (1978), Ph.D., *Professor of Civil Engineering*  
 Daniel B. Menzel (1971), Ph.D., *Professor of Pharmacology*  
 Richard S. Metzgar (1962), Ph.D., *Professor of Immunology*  
 Michael J. Meurer (1985), Ph.D., *Assistant Professor of Economics*  
 Johannes Horst Max Meyer (1959), Ph.D., *Professor of Physics*  
 Carol L. Meyers (1979), Ph.D., *Associate Professor of Religion*  
 Eric M. Meyers (1969), Ph.D., *Professor of Religion*  
 George Michalopoulos (1977), M.D., Ph.D., *Professor of Pathology*  
 Agnes K. L. Michels (1981), Ph.D., *Adjunct Professor of Classical Studies*  
 Martin Miller (1970), Ph.D., *Professor of History*  
 Sara Elizabeth Miller (1973), Ph.D., *Associate Medical Research Professor of Microbiology*  
 Elliott Mills (1968), Ph.D., *Professor of Pharmacology and Associate Professor of Cell Biology*  
 Brent Drennen Mishler (1984), Ph.D., *Assistant Professor of Botany*  
 Thomas G. Mitchell (1974), Ph.D., *Associate Professor of Mycology*  
 Paul L. Modrich (1976), Ph.D., *James B. Duke Professor of Biochemistry*  
 Michael Moon (1987), Ph.D., *Assistant Professor of English*  
 John Kevin Moore (1984), J.D., *Adjunct Assistant Professor of Health Administration*  
 John W. Moore (1961), Ph.D., *Professor of Neurobiology*  
 Lawrence C. Moore, Jr. (1966), Ph.D., *Associate Professor of Mathematics*  
 Michael Moore (1984), Ph.D., *Assistant Professor of Business Administration*  
 David R. Morrison (1986), Ph.D., *Associate Professor of Mathematics*  
 Michael M. Morton (1985), Ph.D., *Assistant Professor of German*  
 Michael Moses (1987), Ph.D., *Assistant Professor of English*  
 Montrose J. Moses (1959), Ph.D., *Professor of Cell Biology*  
 Valentin Mudimbe (1987), Ph.D., *Professor of Romance Languages*  
 George C. Myers (1968), Ph.D., *Professor of Sociology*  
 Gopalan Nadathur (1986), *Assistant Professor of Computer Science*  
 J. Victor Nadler (1978), Ph.D., *Associate Professor of Pharmacology and Associate Professor of Neurobiology*  
 Dana W. Nance (1983), Ph.D., *Assistant Professor of Mathematics*  
 Sydney Nathans (1966), Ph.D., *Associate Professor of History*  
 Robert F. Nau (1985), Ph.D., *Assistant Professor of Business Administration*  
 Thomas H. Naylor (1964), Ph.D., *Professor of Economics*  
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 Charles B. Nemeroff (1983), Ph.D., *Associate Professor of Pharmacology*  
 Kristen B. Neuschel (1982), Ph.D., *Assistant Professor of History*  
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 Robert Bruce Nicklas (1965), Ph.D., *Professor of Zoology*  
 James Edward Niedel (1986), M.D., Ph.D., *Assistant Professor of Pharmacology*  
 Frederik Nijhout (1977), Ph.D., *Professor of Zoology*  
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 Emerson Niou (1988), Ph.D., *Assistant Professor of Political Science*  
 Loren W. Nolte (1966), Ph.D., *Professor of Electrical Engineering and Professor of Biomedical Engineering*  
 Stephen Nowicki (1984), Ph.D., *Assistant Professor of Zoology*  
 Holger O. Nygard (1960), Ph.D., *Professor of English*  
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 Jean Fox O'Barr (1969), Ph.D., *Adjunct Associate Professor of Political Science*  
 William M. O'Barr (1969), Ph.D., *Professor of Cultural Anthropology and Professor of Sociology*  
 Fearghus O'Foghludha (1975), Ph.D., *Adjunct Professor of Physics*  
 Seog Hwan Oh (1984), Ph.D., *Assistant Professor of Physics*  
 Angela O'Rand (1979), Ph.D., *Associate Professor of Sociology*  
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 Charles Barry Osmond (1986), Ph.D., *Arts and Sciences Professor of Botany*  
 Suydam Osterhout (1959), M.D., Ph.D., *Professor of Microbiology*  
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 George M. Padilla (1965), Ph.D., *Professor of Cell Biology*  
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 David L. Paletz (1967), Ph.D., *Professor of Political Science*  
 Richard A. Palmer (1966), Ph.D., *Professor of Chemistry*  
 Richard G. Palmer (1977), Ph.D., *Associate Professor of Physics*  
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 Vassilis G. Papanicolaou (1988), Ph.D., *Assistant Professor of Mathematics*  
 William Leslie Pardon (1977), Ph.D., *Associate Professor of Mathematics*  
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 J. Jeffrey Peirce (1981), Ph.D., *Associate Professor of Civil and Environmental Engineering*  
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Donald J. Rose (1984), Ph.D., *Professor of Computer Science and Professor of Mathematics*

Bruce R. Rosendahl (1976), Ph.D., *Professor of Geology*

Kathleen A. Ross (1984), Ph.D., *Assistant Professor of Romance Languages*

Wendell F. Rosse (1966), M.D., *Professor of Immunology*

Susan Roth (1973), Ph.D., *Associate Professor of Psychology*

Virginia Louise Roth (1983), Ph.D., *Assistant Professor of Zoology*

David C. Rubin (1978), Ph.D., *Professor of Psychology*

Joan V. Ruderman (1986), Ph.D., *Professor of Zoology and Associate Professor of Microbiology*

Jeffrey Rummel (1986), Ph.D., *Assistant Professor of Business Administration*

Clyde de Loache Ryals (1973), Ph.D., *Professor of English*

Harvey J. Sage (1964), Ph.D., *Associate Professor of Biochemistry and Associate Professor of Immunology*

Alfred Paul Sanfilippo (1979), M.D., Ph.D., *Associate Professor of Pathology*

David H. Sanford (1970), Ph.D., *Professor of Philosophy*

Leslie D. Saper (1986), Ph.D., *Associate Professor of Mathematics*

Rakesh Sarin (1986), Ph.D., *Professor of Business Administration*

Robert N. Sawyer (1976), Ed.D., *Associate Professor of Education*

Frederick H. Schachat (1977), Ph.D., *Associate Professor of Cell Biology*

David G. Schaeffer (1978), Ph.D., *Professor of Mathematics*

Saul M. Schanberg (1967), M.D., Ph.D., *Professor of Pharmacology*

Susan S. Schiffman (1972), Ph.D., *Adjunct Professor of Psychology*

William H. Schlesinger (1980), Ph.D., *Professor of Botany*

David M. Schlossman (1985), M.D., Ph.D., *Assistant Professor of Biochemistry*

Klaus Schmidt-Koenig (1983), Ph.D., *Adjunct Professor of Zoology*  
 Chadmark L. Schoen (1982), Ph.D., *Assistant Professor of Mathematics*  
 Stanley Clifford Schold, Jr. (1978), M.D., *Assistant Professor of Pathology*  
 David W. Schomberg (1968), Ph.D., *Associate Professor of Cell Biology*  
 Regina Schwartz (1987), Ph.D., *Associate Professor of English*  
 Rochelle D. Schwartz (1986), Ph.D., *Assistant Professor of Pharmacology*  
 Laura Schweitzer (1987), Ph.D., *Assistant Medical Research Professor of Neurobiology*  
 Anne Firor Scott (1961), Ph.D., *William K. Boyd Professor of History*  
 Julius S. Scott (1988), Ph.D., *Assistant Professor of History*  
 William E. Scott (1958), Ph.D., *Professor of History*  
 Richard A. Scoville (1961), Ph.D., *Associate Professor of Mathematics*  
 Richard B. Searles (1965), Ph.D., *Professor of Botany*  
 Eve K. Sedgwick (1988), Ph.D., *Assistant Professor of English*  
 Tilmann Seebass (1977), Ph.D., *Associate Professor of Music*  
 Hilliard Foster Seigler (1967), M.D., *Professor of Immunology*  
 Edward J. Shaughnessy, Jr. (1975), Ph.D., *Professor of Mechanical Engineering*  
 Barbara Ramsay Shaw (1975), Ph.D., *Associate Professor of Chemistry*  
 John Shelburne (1973), M.D., Ph.D., *Professor of Pathology*  
 Marion L. Shepard (1967), Ph.D., *Professor of Materials Science*  
 Blair H. Sheppard (1981), Ph.D., *Associate Professor of Business Administration*  
 Sudhir Shetty (1984), Ph.D., *Assistant Professor of Public Policy Studies and Assistant Professor of Economics*  
 Joseph R. Shoenfield (1952), Ph.D., *Professor of Mathematics*  
 Stephanie Sieburth (1987), Ph.D., *Assistant Professor of Romance Languages*  
 James N. Siedow (1976), Ph.D., *Professor of Botany*  
 Lewis M. Siegel (1968), Ph.D., *Professor of Biochemistry*  
 Alexander Silbiger (1984), Ph.D., *Professor of Music*  
 Sidney Arthur Simon (1974), Ph.D., *Professor of Neurobiology*  
 Elwyn L. Simons (1977), Ph.D., D.Phil., *James B. Duke Professor of Biological Anthropology and Anatomy*  
 Ida Harper Simpson (1959), Ph.D., *Professor of Sociology*  
 Kay H. Singer (1979), Ph.D., *Assistant Medical Research Professor of Microbiology and Immunology*  
 William R. Sizemore (1982), Ph.D., *Adjunct Professor of Forestry*  
 Theodore Alan Slotkin (1971), Ph.D., *Professor of Pharmacology*  
 Barbara Herrnstein Smith (1987), Ph.D., *Braxton Craven Professor of Comparative Literature and English*  
 Carol A. Smith (1974), Ph.D., *Associate Professor of Cultural Anthropology*  
 D. Moody Smith (1965), Ph.D., *George Washington Ivey Professor of New Testament Interpretation*  
 David A. Smith (1962), Ph.D., *Associate Professor of Mathematics*  
 Donald S. Smith II (1961), M.H.A., *Assistant Professor of Health Administration*  
 Grover C. Smith (1952), Ph.D., *Professor of English*  
 Harmon L. Smith (1959), Ph.D., *Professor of Religion, Moral Theology*  
 Joel Smith (1958), Ph.D., *Professor of Sociology*  
 Kathleen K. Smith (1980), Ph.D., *Associate Professor of Biological Anthropology and Anatomy*  
 Peter Smith (1959), Ph.D., *Professor of Chemistry*  
 Steven Smith (1988), Ph.D., *Assistant Professor of Public Policy Studies and Assistant Professor of Political Science*  
 Helen Solterer (1986), *Assistant Professor of Romance Languages*  
 George G. Somjen (1963), M.D., *Professor of Cell Biology and Professor of Neurobiology*  
 Joachim R. Sommer (1957), M.D., *Professor of Pathology and Professor of Cell Biology*  
 Madison S. Spach (1958), M.D., *Professor of Cell Biology*  
 John R. Spencer (1978), Ph.D., *Professor of Art History*  
 Kenneth I. Spenner (1984), Ph.D., *Associate Professor of Sociology*  
 Leonard Spicer (1984), Ph.D., *Professor of Biochemistry*  
 Thomas Arthur Spragens, Jr. (1967), Ph.D., *Professor of Political Science*  
 Carol B. Stack (1975), Ph.D., *Associate Professor of Public Policy Studies and Adjunct Associate Professor of Anthropology*  
 John E. R. Staddon (1967), Ph.D., *James B. Duke Professor of Psychology, Professor of Neurobiology, and Professor of Zoology*  
 Richard Staelin (1982), Ph.D., *Edward and Rose Donnell Professor of Business Administration*  
 William J. Stambaugh (1961), Ph.D., *Professor of Forest Pathology*  
 Dennis Keith Stanley (1961), Ph.D., *Associate Professor of Classical Studies*  
 Charles Franklin Starmer, Jr. (1966), Ph.D., *Professor of Computer Science*  
 Deborah A. Steege (1977), Ph.D., *Associate Professor of Biochemistry*  
 Harold K. Steen (1985), Ph.D., *Adjunct Professor of Forestry and Environmental Studies*  
 David Curtis Steinmetz (1971), Th.D., *Professor of Religion, Church History and Doctrine*  
 Jens A. Stephan (1984), Ph.D., *Assistant Professor of Business Administration*  
 Mark Andrew Stern (1985), Ph.D., *Associate Professor of Mathematics*  
 Philip Stewart (1972), Ph.D., *Professor of Romance Languages*  
 Donald E. Stone (1963), Ph.D., *Professor of Botany*

Boyd R. Strain (1969), Ph.D., *Professor of Botany*  
 Victor H. Strandberg (1966), Ph.D., *Professor of English*  
 Harold Carl Strauss (1972), M.D., *Professor of Pharmacology*  
 Richard A. Strelitz (1984), Ph.D., *Assistant Professor of Geology*  
 Howard Austin Strobel (1948), Ph.D., *Professor of Chemistry*  
 Norman C. Strole (1968), Ph.D., *Adjunct Assistant Professor of Electrical Engineering*  
 Akio Sugino (1986), Ph.D., *Adjunct Assistant Professor of Genetics*  
 Judy Sund (1986), Ph.D., *Assistant Professor of Art History*  
 J. Bolling Sullivan (1970), Ph.D., *Associate Professor of Biochemistry*  
 Kenneth Surin (1987), Ph.D., *Associate Professor of Religion*  
 John P. Sutherland (1969), Ph.D., *Associate Professor of Zoology*  
 Judith Swain (1987), M.D., *Associate Professor of Microbiology and Immunology*  
 James A. Swenberg (1979), D.V.M., Ph.D., *Adjunct Associate Professor of Pathology*  
 Avis L. Sylvia (1977), Ph.D., *Associate Medical Research Professor of Cell Biology*  
 Daniel B. Szyld (1986), Ph.D., *Professor of Computer Science*  
 Teh Yu Tan (1986), Ph.D., *Professor of Materials Science*  
 George E. Tauchen (1977), Ph.D., *Professor of Economics*  
 Roger Trans-Son Tay (1987), Ph.D., *Research Assistant Professor of Mechanical Engineering and Materials Science*  
 Kenneth Allen Taylor (1980), Ph.D., *Associate Medical Research Professor of Cell Biology*  
 Robert Taylor (1983), Ph.D., *Associate Professor of Health Administration*  
 John J. TePaske (1967), Ph.D., *Professor of History*  
 Marcel Tetel (1960), Ph.D., *Professor of Romance Languages*  
 John E. Thomas (1987), Ph.D., *Associate Professor of Physics*  
 Jean-Jacques Thomas (1981), Doctorat de 3e Cycle, *Associate Professor of Romance Languages*  
 Robert J. Thompson, Jr. (1984), Ph.D., *Adjunct Professor of Psychology*  
 Fredrick L. Thurstone (1967), Ph.D., *Professor of Biomedical Engineering*  
 Edward A. Tiryakian (1965), Ph.D., *Professor of Sociology*  
 R. Larry Todd (1978), Ph.D., *Associate Professor of Music*  
 Jane Tompkins (1985), Ph.D., *Professor of English*  
 Robert E. Toomey (1980), LL.D., *Adjunct Professor of Health Administration*  
 Marianna Torgovnick (1981), Ph.D., *Professor of English*  
 Edward Tower (1974), Ph.D., *Professor of Economics*  
 Gregg E. Trahey (1985), Ph.D., *Assistant Professor of Biomedical Engineering*  
 Vladimir G. Treml (1967), Ph.D., *Professor of Economics*  
 Kishor S. Trivedi (1975), Ph.D., *Professor of Computer Science and Professor of Electrical Engineering*  
 George Truskey (1987), Ph.D., *Assistant Professor of Biomedical Engineering and Assistant Professor of Biochemical Engineering*  
 Vance Tucker (1964), Ph.D., *Professor of Zoology*  
 Clare Tufts (1987), Ph.D., *Lecturer in Romance Languages*  
 William Turner (1987), Ph.D., *Assistant Professor of Religion, Theology and Black Church Studies*  
 E. Lee Tyrey (1970), Ph.D., *Associate Professor of Neurobiology*  
 Senol Utku (1970), Sc.D., *Professor of Civil Engineering and Professor of Computer Science*  
 Marcy K. Uyenoyama (1982), Ph.D., *Associate Professor of Zoology*  
 Stephanos Venakides (1986), Ph.D., *Associate Professor of Mathematics*  
 John M. Vernon (1966), Ph.D., *Professor of Economics*  
 P. Aarne Vesilind (1970), Ph.D., *Professor of Civil and Environmental Engineering*  
 Dan O. Via, Jr. (1984), Ph.D., *Professor of Religion, New Testament*  
 Steven Vigna (1987), Ph.D., *Associate Professor of Cell Biology*  
 Rytas J. Vilgalys (1986), Ph.D., *Assistant Professor of Botany*  
 Elia E. Villanueva (1969), A.M., *Associate Professor of Physical Therapy*  
 S. Viswanathan (1986), Ph.D., *Assistant Professor of Business Administration*  
 F. Stephen Vogel (1961), M.D., *Professor of Pathology*  
 Steven Vogel (1966), Ph.D., *Professor of Zoology*  
 Robin T. Vollmer (1975), M.D., *Assistant Clinical Professor of Pathology*  
 Olaf T. von Ramm (1974), Ph.D., *Professor of Biomedical Engineering*  
 Robert A. Wagner (1978), Ph.D., *Associate Professor of Computer Science*  
 Geoffrey Wainwright (1983), Dr.Théol., *Professor of Religion, Systematic Theology*  
 Stephen A. Wainwright (1964), Ph.D., *James B. Duke Professor of Zoology*  
 William D. Walker (1971), Ph.D., *Professor of Physics*  
 Andrew G. Wallace (1964), M.D., *Assistant Professor of Cell Biology*  
 T. Dudley Wallace (1974), Ph.D., *James B. Duke Professor of Economics*  
 Lise Wallach (1970), Ph.D., *Adjunct Professor of Psychology*  
 Michael A. Wallach (1962-72; 1973), Ph.D., *Professor of Psychology*  
 Richard L. Walter (1962), Ph.D., *Professor of Physics*  
 Paul P. Wang (1968), Ph.D., *Professor of Electrical Engineering*  
 Calvin L. Ward (1952), Ph.D., *Professor of Zoology*



Frances Ellen Ward (1969), Ph.D., *Professor of Immunology*  
 Bruce W. Wardropper (1962), Ph.D., *William Hanes Wannamaker Professor of Romance Languages*  
 Seth L. Warner (1955), Ph.D., *Professor of Mathematics*  
 David Grant Warren (1975), J.D., *Professor of Health Administration*  
 W. David Watkins (1984), M.D., Ph.D., *Professor of Pharmacology*  
 Robert E. Webster (1970), Ph.D., *Professor of Biochemistry*  
 E. Roy Weintraub (1970), Ph.D., *Professor of Economics*  
 Morris Weisfeld (1967), Ph.D., *Professor of Mathematics*  
 Jay M. Weiss (1984), Ph.D., *Adjunct Professor of Psychology*  
 Henry R. Weller (1978), Ph.D., *Professor of Physics*  
 Robert P. Weller (1980), Ph.D., *Assistant Professor of Anthropology*  
 Richard L. Wells (1962), Ph.D., *Professor of Chemistry*  
 Robert E. Whaley (1986), Ph.D., *Associate Professor of Business Administration*  
 Annabel Wharton (1979), Ph.D., *Associate Professor of Art*  
 Robert W. Wheat (1958), Ph.D., *Professor of Microbiology*  
 Richard A. White (1963), Ph.D., *Professor of Botany*  
 Richard Whorton (1979), Ph.D., *Associate Professor of Pharmacology*  
 Carol J. Wikstrand (1975), Ph.D., *Associate Medical Research Professor of Pathology*  
 Henry M. Wilbur (1973), Ph.D., *Professor of Zoology*  
 Robert L. Wilbur (1957), Ph.D., *Professor of Botany*  
 Pelham Wilder, Jr. (1949), Ph.D., *Professor of Chemistry and Professor of Pharmacology*  
 Hilda Pope Willett (1948), Ph.D., *Professor of Microbiology*  
 George W. Williams (1957), Ph.D., *Professor of English*  
 Kenny J. Williams (1977), Ph.D., *Professor of English*  
 Peter Fredric Williams (1985), Ph.D., *Professor of Music*  
 Robert Sanders Williams (1987), M.D., *Assistant Professor of Cell Biology*  
 James F. Wilson (1967), Ph.D., *Professor of Civil Engineering*  
 John Wilson (1968), D.Phil., *Associate Professor of Sociology*  
 Thomas George Wilson (1959), Sc.D., *Professor of Electrical Engineering*  
 Wilkie Andrew Wilson, Jr. (1974), Ph.D., *Associate Medical Research Professor of Pharmacology*  
 Robert G. Winfree (1974), M.A., *Adjunct Associate Professor of Health Administration*  
 Cliff W. Wing, Jr. (1965), Ph.D., *Professor of Psychology*  
 Robert L. Winkler (1984), Ph.D., *Professor of Business Administration*  
 Orval S. Wintermute (1958), Ph.D., *Professor of Religion*  
 Ronald Witt (1971), Ph.D., *Professor of History*  
 Benjamin Wittels (1961), M.D., *Professor of Pathology*  
 Myron L. Wolbarsht (1968), Ph.D., *Professor of Biomedical Engineering and Associate Professor of Neurobiology*  
 Robert L. Wolpert (1984), Ph.D., *Research Associate Professor of Statistics*  
 Ronald C. Wong (1985), Ph.D., *Assistant Professor of Electrical Engineering*  
 Peter H. Wood (1975), Ph.D., *Associate Professor of History*  
 Donald Wright (1967), Ph.D., *Associate Professor of Mechanical Engineering*  
 Patricia Chapple Wright (1983), Ph.D., *Assistant Professor of Biological Anthropology and Anatomy*  
 Duncan Yaggy (1980), Ph.D., *Professor of Public Management in Public Policy Studies and Adjunct Associate Professor of Health Administration*  
 William E. Yarger (1971), M.D., *Assistant Professor of Cell Biology*  
 William P. Yohe (1958), Ph.D., *Professor of Economics*  
 Charles R. Young (1954), Ph.D., *Professor of History*  
 John G. Younger (1974), Ph.D., *Associate Professor of Classical Studies*  
 Michael Rod Zalutsky (1986), Ph.D. *Assistant Professor of Pathology*  
 Gary A. Zarkin (1982), Ph.D., *Assistant Professor of Economics*  
 Peter Zwadyk, Jr. (1971), Ph.D., *Associate Professor of Pathology*

## Professors Emeriti

John Richard Alden (1955), Ph.D., *James B. Duke Professor Emeritus of History*  
 Lewis Edward Anderson (1936), Ph.D., *Professor Emeritus of Botany*  
 Roger Fabian Anderson (1950), Ph.D., *Professor Emeritus of Entomology*  
 Joseph Randle Bailey (1946), Ph.D., *Professor Emeritus of Zoology*  
 Frank Baker (1960), Ph.D., *Professor Emeritus of English Church History*  
 M. Margaret Ball (1963), Ph.D., *Professor Emeritus of Political Science*  
 Katharine May Banham (1946), Ph.D., *Associate Professor Emeritus of Psychology*  
 William Waldo Beach, (1946), Ph.D., *Professor Emeritus of Christian Ethics*  
 Frederick Bernheim (1930), Ph.D., *James B. Duke Professor Emeritus of Pharmacology*  
 Mary L. C. Bernheim (1930), Ph.D., *Professor Emeritus of Biochemistry*  
 William Dwight Billings (1952), Ph.D., *James B. Duke Professor Emeritus of Botany*  
 Cazlyn Green Bookhout (1935), Ph.D., *Professor Emeritus of Zoology*

Lloyd J. Borstelmann (1953), Ph.D., *Professor Emeritus of Psychology*  
 Benjamin Boyce (1950), Ph.D., *James B. Duke Professor Emeritus of English*  
 David G. Bradley (1949), Ph.D. *Professor Emeritus of Religion*  
 Charles Kilgo Bradsher (1939), Ph.D., *James B. Duke Professor Emeritus of Chemistry*  
 Martin Bronfenbrenner (1971), Ph.D., *William R. Kenan, Jr. Professor Emeritus of Economics*  
 Earl Ivan Brown II (1960), Ph.D., *J. A. Jones Professor Emeritus of Civil Engineering*  
 Frances Campbell Brown (1931), Ph.D., *Professor Emeritus of Chemistry*  
 Edwin H. Cady (1973), Ph.D., *Andrew W. Mellon Professor Emeritus in the Humanities*  
 Leonard Carlitz (1932), Ph.D., *James B. Duke Professor Emeritus of Mathematics*  
 William H. Cartwright (1951), Ph.D., *Professor Emeritus of Education*  
 Frederic N. Cleaveland (1971), Ph.D., *Professor Emeritus of Political Science*  
 Robert Taylor Cole (1935), Ph.D., *James B. Duke Research Professor Emeritus of Political Science*  
 Joel Colton (1947), Ph.D., *Professor Emeritus of History*  
 Robert Merle Colver (1953), Ed.D., *Associate Professor Emeritus of Education*  
 Robert E. Cushman (1945), Ph.D., *Research Professor Emeritus of Systematic Theology*  
 Bingham Dai (1943), Ph.D., *Professor Emeritus of Psychology*  
 William D. Davies (1966), D.D., F.B.A., *George Washington Ivey Professor Emeritus of Advanced Studies and Research in Christian Origins*  
 Eugene Davis Day (1962), Ph.D., *Professor Emeritus of Immunology*  
 Neal Dow (1934), Ph.D., *Professor Emeritus of Romance Languages*  
 Francis George Dressel (1929), Ph.D., *Professor Emeritus of Mathematics*  
 Kenneth Lindsay Duke (1940), Ph.D., *Associate Professor Emeritus of Biological Anthropology and Anatomy*  
 Howard Easley (1930), Ph.D., *Associate Professor Emeritus of Education*  
 William Whitfield Elliott (1925), Ph.D., *Professor Emeritus of Mathematics*  
 Ernest Elsevier (1950), M.S., *Associate Professor Emeritus of Mechanical Engineering*  
 John Wendell Everett (1932), Ph.D., *Professor Emeritus of Neurobiology*  
 Arthur Bowles Ferguson (1939), Ph.D., *Professor Emeritus of History*  
 Wallace Fowlie (1964), Ph.D., *James B. Duke Professor Emeritus of Romance Languages*  
 John Hope Franklin (1981), Ph.D., *James B. Duke Professor Emeritus of History*  
 Ernestine Friedl (1973), Ph.D., *James B. Duke Professor Emeritus of Anthropology*  
 William J. Furbish (1954), M.S., *Associate Professor Emeritus of Geology*  
 W. Scott Gehman, Jr. (1954), Ph.D., *Professor Emeritus of Psychology in Education*  
 Clarence Gohdes (1930), Ph.D., *James B. Duke Professor Emeritus of English*  
 Walter Gordy (1946), Ph.D., *James B. Duke Professor Emeritus of Physics*  
 John R. Gregg (1957), Ph.D., *Professor Emeritus of Zoology*  
 Kazimierz Grzybowski (1967), S.J.D., *Professor Emeritus of Political Science*  
 Hugh Marshall Hall, Jr. (1952), Ph.D., *Professor Emeritus of Political Science*  
 Louise Hall (1931), Ph.D., *Professor Emeritus of Architecture*  
 John Hamilton Hallowell (1942), Ph.D., *James B. Duke Professor Emeritus of Political Science*  
 Jerome S. Harris (1936), M.D., *Professor Emeritus of Biochemistry*  
 William S. Heckscher (1966), Ph.D., *Benjamin N. Duke Professor Emeritus of Art*  
 Henry Hellmers (1965), Ph.D., *Professor Emeritus of Botany and Professor Emeritus of Forestry*  
 Stuart C. Henry (1959), Ph.D., *Professor Emeritus of American Christianity*  
 Marcus Edwin Hobbs (1935), Ph.D., *University Distinguished Service Professor Emeritus of Chemistry*  
 Irving B. Holley, Jr. (1947), Ph.D., *Professor Emeritus of History*  
 Everett H. Hopkins (1961), M.A., LL.D., *Professor Emeritus of Education*  
 Wanda S. Hunter (1947), Ph.D., *Associate Professor Emeritus of Zoology*  
 Allan S. Hurlburt (1956), Ph.D., *Professor Emeritus of Education*  
 Benjamin A. Jayne (1976), Ph.D., *Professor Emeritus of Forestry*  
 Marianna Jenkins (1948), Ph.D., *Professor Emeritus of Art*  
 Bronislas de Leval Jezierski (1958), Ph.D., *Associate Professor Emeritus of Slavic Languages and Literatures*  
 Terry W. Johnson, Jr. (1954), Ph.D., *Professor Emeritus of Botany*  
 Brady Rimbe Jordan (1927), Ph.D., *Professor Emeritus of Romance Languages*  
 Gregory A. Kimble (1952-68; 1977), Ph.D., *Professor Emeritus of Psychology*  
 Paul Jackson Kramer (1931), Ph.D., *James B. Duke Professor Emeritus of Botany*  
 William R. Krigbaum (1952), Ph.D., *James B. Duke Professor Emeritus of Chemistry*  
 Magnus Jan Krynski (1966), Ph.D., *Professor Emeritus of Slavic Languages and Literatures*  
 Wladyslaw W. Kulski (1963), Ph.D., LL.D., *James B. Duke Professor Emeritus of Russian Affairs*  
 Weston LaBarre (1946), Ph.D., *James B. Duke Professor Emeritus of Anthropology*  
 Creighton Lacy (1953), Ph.D., *Professor Emeritus of World Christianity*  
 Harold Walter Lewis (1946), Ph.D., *University Distinguished Service Professor Emeritus of Physics*  
 H. Gregg Lewis (1975), Ph.D., *Professor Emeritus of Economics*  
 John L. Lievsay (1962), Ph.D., *James B. Duke Professor Emeritus of English*  
 L. Sigfred Linderoth, Jr. (1965), M.E., *Professor Emeritus of Mechanical Engineering*  
 John C. McKinney (1957), Ph.D., *Professor Emeritus of Sociology*  
 John Nelson Macduff (1956), M.M.E., *Professor Emeritus of Mechanical Engineering*

Sidney David Markman (1947), Ph.D., *Professor Emeritus of Art History and Professor Emeritus of Archaeology*  
 Earl George Mueller (1945), Ph.D., *Professor Emeritus of Art*  
 Roland E. Murphy (1967-68; 1971), S.T.D., *George Washington Ivey Professor Emeritus of Old Testament*  
 Francis Joseph Murray (1960), Ph.D., *Professor Emeritus of Mathematics*  
 Aubrey Willard Naylor (1952), Ph.D., *James B. Duke Professor Emeritus of Botany*  
 Yasuhiko Nozaki (1966), Ph.D., *Associate Professor Emeritus of Biochemistry*  
 James G. Osborne (1961), B.S., *Professor Emeritus of Forest Biometry*  
 Harry Ashton Owen, Jr. (1951), Ph.D., *Professor Emeritus of Electrical Engineering*  
 Harold Talbot Parker (1939), Ph.D., *Professor Emeritus of History*  
 Lewis Patton (1926), Ph.D., *Professor Emeritus of English*  
 William Bernard Peach (1951), Ph.D., *Professor Emeritus of Philosophy*  
 Ray C. Petry (1937), Ph.D., LL.D., *James B. Duke Professor Emeritus of Church History*  
 Olan Lee Petty (1952), Ph.D., *Professor Emeritus of Education*  
 Leland R. Phelps (1961), Ph.D., *Professor Emeritus of Germanic Languages and Literature*  
 Jane Philpott (1951), Ph.D., *Professor Emeritus of Botany and Professor Emeritus of Wood Anatomy*  
 Jacques C. Poirier (1955), Ph.D., *Professor Emeritus of Chemistry*  
 William H. Poteat (1960), Ph.D., *Professor Emeritus of Religion and Professor Emeritus of Comparative Studies*  
 Jack J. Preiss (1959), Ph.D., *Professor Emeritus of Sociology*  
 Richard A. Preston (1965), Ph.D., *William K. Boyd Professor Emeritus of History*  
 James Ligon Price, Jr. (1952), *Professor Emeritus of Religion*  
 Louis DuBose Quin (1957), Ph.D., *James B. Duke Professor Emeritus of Chemistry*  
 Theodore Ropp (1938), Ph.D., *Professor Emeritus of History*  
 Mabel F. Rudisill (1948), Ph.D., *Associate Professor Emeritus of Education*  
 Charles Richard Sanders (1937), Ph.D., *Professor Emeritus of English*  
 Lloyd Saville (1946), Ph.D., *Professor Emeritus of Economics*  
 Harold Schiffman (1963), Ph.D., *Professor Emeritus of Psychology*  
 Knut Schmidt-Nielsen (1952), Ph.D., *James B. Duke Professor Emeritus of Physiology and Zoology*  
 William H. Simpson (1930), Ph.D., *Professor Emeritus of Political Science*  
 Joseph John Spengler (1934), Ph.D., *James B. Duke Professor Emeritus of Economics*  
 William Franklin Stinespring (1936), Ph.D., *Professor Emeritus of Old Testament and Semitics*  
 W. A. Stumpf (1948), Ph.D., *Professor Emeritus of Education*  
 Elizabeth Read Sunderland (1939-42; 1943), Ph.D., *Professor Emeritus of Art*  
 Charles Tanford (1960), Ph.D., *James B. Duke Professor Emeritus of Physiology*  
 Edgar Tristram Thompson (1935), Ph.D., *Professor Emeritus of Sociology*  
 James Nardin Truesdale (1930), Ph.D., *Professor Emeritus of Greek*  
 Richard L. Tuthill (1953), Ed.D., *Professor Emeritus of Economic Geography*  
 Patrick R. Vincent (1954), Ph.D., *Associate Professor Emeritus of Romance Languages*  
 Warren Chase Vosburgh (1928), Ph.D., *Professor Emeritus of Chemistry*  
 Richard Lyness Watson, Jr. (1939), Ph.D., *Professor Emeritus of History*  
 Henry Weitz (1950), Ed.D., *Professor Emeritus of Education*  
 Paul Welsh (1948), Ph.D., *Professor Emeritus of Philosophy*  
 Karl Milton Wilbur (1946), Ph.D., *James B. Duke Professor Emeritus of Zoology*  
 William Hailey Willis (1963), Ph.D., *Professor Emeritus of Greek in Classical Studies*  
 Max A. Woodbury (1966), Ph.D., *Professor Emeritus of Computer Science*  
 Robert Hilliard Woody (1929), Ph.D., *Professor Emeritus of History*  
 James G. Yoho (1984), Ph.D., *Professor Emeritus of Forestry*  
 Franklin W. Young (1944-50; 1968), *Amos Ragan Kearns Professor Emeritus of New Testament and Patristic Studies*




## To the Prospective Graduate Student

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For the student in search of a strong graduate education, Duke University has much to offer. This is a community in which minds and ideas grow. We provide training for many careers, but we seek also to foster personal creativity and to provide stimulating yet congenial surroundings for productive education and research.

The following pages provide the information you require in making the important choice of the course of your graduate education. We look forward to welcoming you to the Duke community of scholars.

Malcolm Gillis

A handwritten signature in black ink that reads "Malcolm Gillis". The signature is written in a cursive, flowing style.

*Dean of the Graduate School*

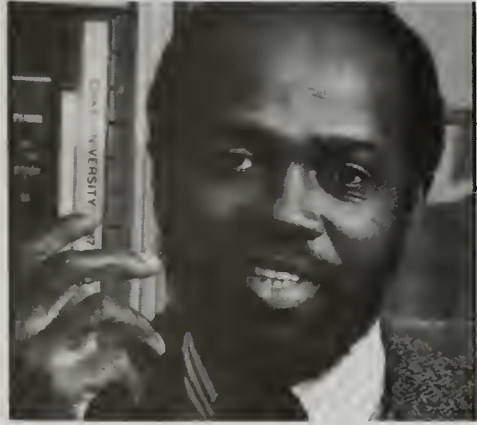
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*Admission*





## Degree and Nondegree Admission

All students seeking a graduate degree from Duke University must formally be admitted to the Graduate School. Prerequisites for admission include a bachelor's degree (or the equivalent) from an accredited institution and satisfactory scores on the Graduate Record Examination. Individual departments may specify additional prerequisites, which can be found in the chapter on "Courses of Instruction."

Students who do not intend to earn an advanced degree at Duke, but who wish to take graduate courses, may apply for nondegree admission. Such admission is granted in three different categories: (1) admission as a regular nondegree student with a particular department; (2) admission as a special nondegree student without departmental affiliation through the Office of Continuing Education; and (3) admission as an unclassified student in the summer session only.

Credits earned by nondegree students in graduate courses taken at Duke before full admission to the Graduate School may be carried over into a graduate degree program if (1) the action is recommended by the student's Director of Graduate Studies and approved by the Dean, (2) the work is not more than two years old, (3) the amount of such credit does not exceed 12 units, and (4) the work has received grades of G or better.

Students who have discontinued a program of degree work at Duke must apply for readmission to the Graduate School. Those who discontinue study *prior* to completing a degree must, by letter, request permission of the Dean to be readmitted to the degree program; those who discontinue study *after* earning a master's degree must file a new application for the doctoral program.

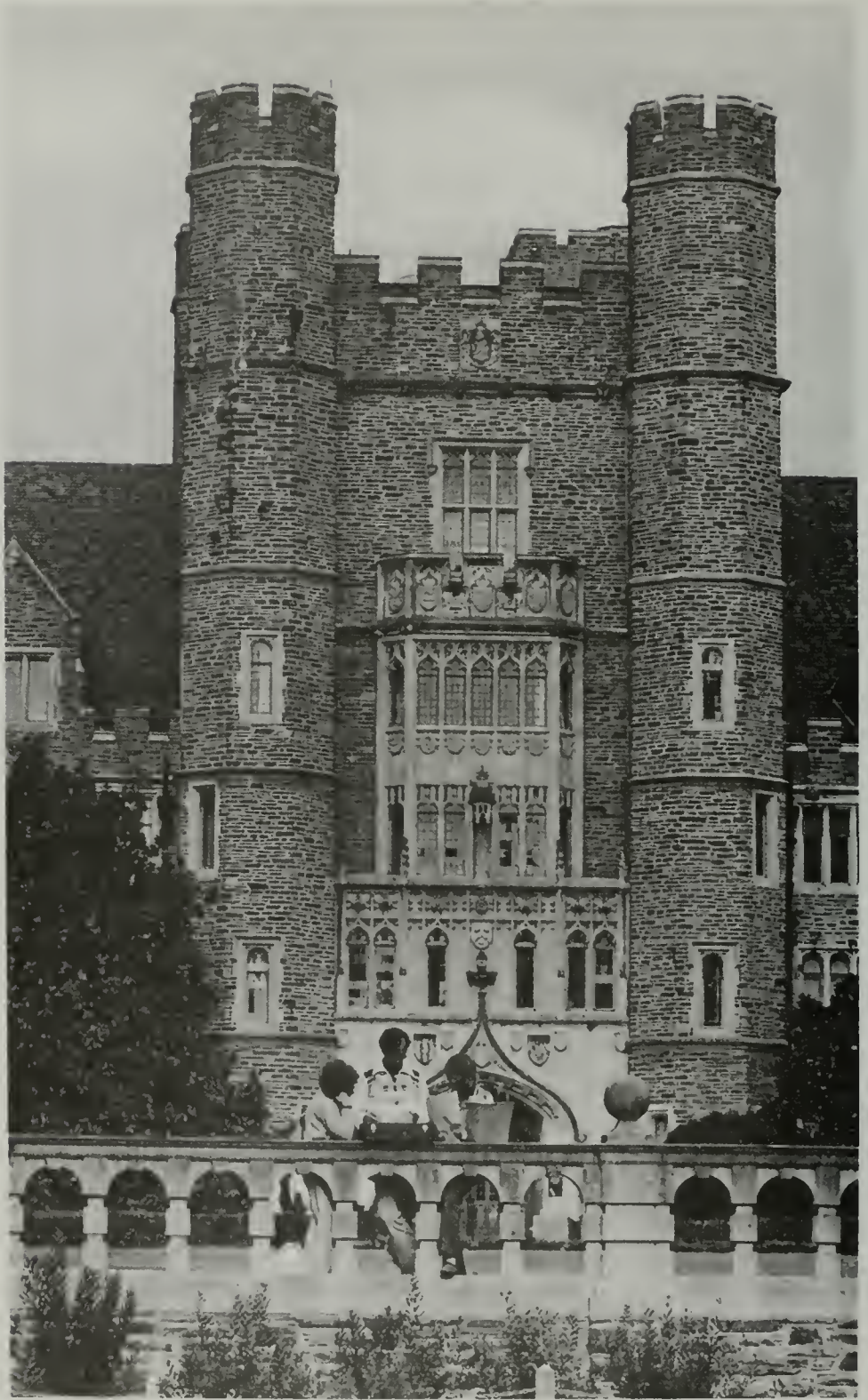
## Admission Procedures\*

A student seeking admission to the Graduate School should obtain an application packet from the Graduate School Admissions Office. This packet contains the necessary forms and detailed instructions on how to apply. The application form and accompanying Summary Data sheet must be filled out completely, signed, and returned to the Graduate Admissions Office accompanied by a nonrefundable fee of \$50† in U.S. currency (check or money order payable to Duke University). In addition, the student must provide the following supporting documents: (1) two copies of the official, confidential transcript from each postsecondary institution attended, sent directly to the Graduate School by the

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\*This chapter is a brief summary of, and supplement to, information contained in the current Graduate School "Information for Applicants" booklet. This booklet is part of a standard application packet, which should be consulted for more comprehensive information on all aspects of the process of applying for admission and award.

†All fees are based on current charges and are subject to change without notice.



institution; (2) three letters of evaluation, written on the forms provided and returned by the applicant in the confidential envelopes that have been sealed-then-signed by the evaluators (or returned directly to the Graduate School by the evaluator); (3) official scores on the Graduate Record Examination General Test for applicants to all departments; and (4) official scores on the Graduate Record Examination Subject Test for applicants to certain specified departments. Please consult the current application packet for more detailed information on all requirements.

Applications cannot be reviewed until all supporting documents are on file. *Materials submitted in support of an application are not released for other purposes and cannot be returned to the applicant.*

Students applying for fall admission and award should take the Graduate Record Examination no later than the October testing in the previous year in order to meet our deadlines. Information on the times and places of the Graduate Record Examinations can be obtained from the applicant's college or the Educational Testing Service, P.O. Box 6000, Princeton, New Jersey 08541-6000.

**Additional Procedures for Foreign Students.** Fully qualified students from outside the United States are invited to apply for admission to full-time study in the Graduate School. The foreign student must, in addition to the information required of all students, submit with the application materials: (1) if the student's native language is not English, certification of English proficiency demonstrated by official scores from the Test of English as a Foreign Language (TOEFL), administered through the Educational Testing Service, P.O. Box 6155, Princeton, New Jersey, 08541-6155 (the Graduate School requires a minimum score of 550); and (2) a statement showing financial arrangements for the proposed term at Duke (estimated costs per calendar year are about \$19,500).\*

During new matriculants' first registration period at Duke, every foreign student whose native language is not English will be required to take a test to verify competence in the use of oral and written English. Students found to lack necessary competence will be expected to undertake additional English language instruction. Students who do not perform satisfactorily on the competency test by the end of their first year of residency will not be permitted to continue graduate work at Duke University. Please note that the competency test does not take the place of the TOEFL 550 requirement, nor does passing the competency examination meet degree requirements for a foreign language.

**Part-Time Graduate Study.** Many graduate departments will consider applications from students wishing to pursue degree study on a full-time or part-time basis. (Consult application materials for listing of departments.) Admission requirements, procedures, and deadlines are the same in either case. See the chapter on "Registration" for additional rules governing minimum registration, time limitations, and financial aid restrictions on part-time study. *Visa restrictions do not allow nonimmigrant students to pursue graduate study on a part-time basis.*

**Master of Arts in Liberal Studies Procedures.** Students seeking admission to the MALS should contact that program directly for information, requirements, and special application materials.

**Summer Session Procedures.** Students who wish to begin graduate work during the summer must, in addition to applying for regular admission to the Graduate School, apply for admission to the summer session. Application forms may be obtained from Summer Session, 121 Allen Building, Duke University, Durham, North Carolina 27706, and may be submitted at the time of registration.

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\*Figures are based on 1988-89 charges and are subject to change before the fall 1989 semester.





Students who wish to take graduate courses in the summer but not pursue a graduate degree may be admitted to the summer session under the following categories. *Duke Students*: current students in good standing may attend the summer session without formal application. *Non-Duke Students*: other persons may seek admission to the summer session provided they are (or were) in good standing at a fully accredited college or university.

**Continuing Education Procedures.** A student seeking admission as a nondegree continuing education graduate student at Duke must have received a bachelor's degree and must either reside in the area or be moving to the area with the intention of residing here for a substantial period of time. Application materials and additional information may be obtained from the Office of Continuing Education, The Bishop's House, Duke University, Durham, North Carolina 27708, telephone (919) 684-6259.

**Review of Application and Notification of Status.** All applications are considered without regard to race, color, religion, national origin, handicap, veteran status, sexual orientation or preference, sex, or age.

Application files are assembled in the Graduate Admissions Office, where all official record-keeping is maintained. Applications, when complete, are sent to the departments. A departmental admissions committee, usually headed by the Director of Gradu-

ate Studies, reviews the applications and makes recommendations to the Dean. Formal admission to the Graduate School is offered only by the Dean, who will contact students in writing. An admission offer is only for the semester specified in the letter of admission, and admission may not be deferred from one term to another.

**Immunizations.** North Carolina Statute G.S.: 130A-155.1 states that no person shall attend a college or university, public, private, or religious, excluding students attending night classes only and students matriculating in off-campus courses, unless a certificate of immunizations against diphtheria, tetanus, whooping cough, poliomyelitis, red measles (rubeola), and rubella is presented to the college or university on or before the first day of matriculation. The required forms and instructions are provided to students in the packet of materials sent with the letter of admission.

## Deadlines for Application

It is the applicant's responsibility to make certain that the Graduate School office has received all required materials before the specified deadlines. Only complete applications can be considered. To ensure that the admissions office will have adequate time to assemble all items submitted on an applicant's behalf, applications should be sent *at least two weeks before the stated deadlines*.

*Consult current application materials for a more detailed explanation of deadlines and their enforcement.*

### FOR FALL SEMESTER

**January 15, 5:00 P.M.** Deadline for *completion* of applications to specified programs (see application materials) for fall 1990.

**January 31, 5:00 P.M.** Deadline for *completion* of applications for admission and award to all other programs for the fall 1990 semester.

January 15/31 are **Priority Filing Dates**. Applications received *and* completed by this date (depending on the program) are guaranteed a review; those received/completed after this date are not guaranteed consideration. Late applications may be considered for admission, only if all spaces have not been filled, and for financial aid, only if funds are still available.

All students seeking fall admission should complete their applications by the Priority Filing Date, since it is likely that enrollment in many departments will be filled soon after this date. Applications which are incomplete on January 15/31 cannot be considered for awards until decisions have been made on all complete applications.

The final cut-off date for processing new applications is July 15. Few departments, however, continue to review applications this late. No applications for fall received after this date will be processed.

### FOR SPRING SEMESTER

**November 1.** Final date for completion of applications for admission to the spring semester, space permitting. Not all departments accept new students for the spring semester, nor is financial aid readily available for spring matriculants.

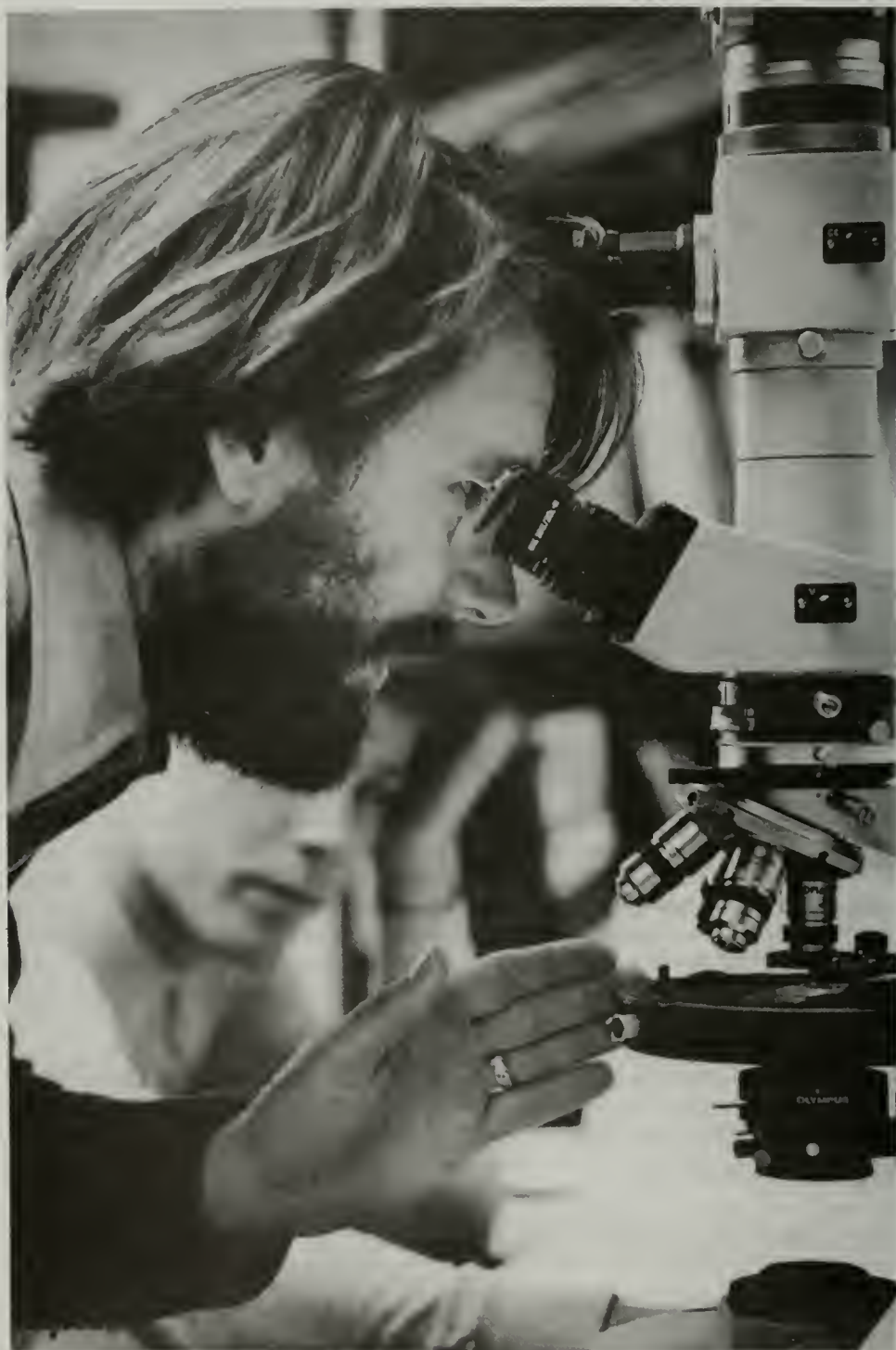
### FOR SUMMER SESSION

Students seeking admission to the Graduate School for study in the summer session should apply to the Dean of the Graduate School and to the Director of the Summer Session.

**April 15.** Last day for completing application to summer session Term I.

**May 15.** Last day for completing application to summer session Term II.

*Financial Information*





## Tuition and Fees\*

### STUDENTS ENROLLING FALL SEMESTER 1988

The 1989-90 tuition for new students enrolling full-time during the fall semester (except those students in health administration and physical therapy) is \$3,840 (12 units at \$320 per unit) or \$2,880 (9 units at \$320 per unit) for teaching and research assistants. In addition to tuition a registration fee of \$450 (not applicable for students who matriculated before fall semester 1985) is required each semester. Part-time tuition is calculated at the rate of \$320 per unit in the fall, spring, and summer.

**Payment of Accounts.** Duke University does not have a deferred payment plan for tuition, fees, or other charges. New students are expected to pay tuition and fees at the time of matriculation. Following first enrollment in the Graduate School, monthly invoices are sent to each student by the Bursar's office. As a part of the agreement of admission to Duke University a student is required to pay all invoices upon receipt.

Graduate students who receive payments from the University for fellowships, assistantships, or employment and who plan to pay tuition and fees and/or campus housing charges via payroll deduction must make arrangements for payroll deduction in the Bursar's office by the published deadline for each semester in order to avoid assessment of the late payment charge.

All full-time graduate students and part-time degree candidates are charged the student health fee as well as student accident and sickness insurance coverage unless they file properly completed and signed insurance waivers in the Bursar's office by the invoice date. Students registered *in absentia* are not charged the health fee and insurance unless they elect to enroll in the insurance plan. *The student accident and sickness insurance payment is due in full at the beginning of the term (insurance may not be paid by payroll deduction). Payment in full for campus housing is due at the beginning of each semester unless the student qualifies for University payroll deduction.*

**Late Payment Charge.** A late registration fee of \$25 is charged any student who does not complete registration during the announced registration periods. Students who fail to pay by the due date the total amount of an invoice received from the Bursar will be charged a late payment fee. That fee is assessed at the rate of 1⅓ percent per month (16 percent per year) applied to the past due balance and accrued from the billing date of the invoice (matriculation date for new students).

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\*All fees are based on current charges and are subject to change without notice.

**Restrictions.** A student in default on tuition or fee charges will not be allowed to register for classes, receive a transcript of academic records, have academic credits certified, be granted a leave of absence, or receive a diploma at graduation. In addition, such students may be subject to withdrawal from the Graduate School.

**Reduction in Registration and Tuition.** Full refunds are granted students who reduce registration on the drop/add date at the beginning of each semester. A reduction in registration and tuition necessitated by changes in departmental service requirements for assistants may be made during the first week of classes with approval of the Dean.

**Refunds for Withdrawal from School during Fall and Spring Semesters.** For students who withdraw from school or who are withdrawn by the University, refunds of tuition and fees are governed by the following policy.

1. In the event of death, refund of full tuition and fees will be granted.
2. In all other cases of withdrawal from the University, students may have tuition refunded according to the following schedule:
  - a. Withdrawal before classes begin: full refund;
  - b. Withdrawal during the first or second week of classes: 80 percent refund (the student health fee will not be refunded);
  - c. Withdrawal during the third, fourth, or fifth week of classes: 60 percent refund (the student health fee will not be refunded);
  - d. Withdrawal during the sixth week: 20 percent refund (the student health fee will not be refunded);
  - e. Withdrawal after the sixth week: no refund.
  - f. Tuition charges paid from grants or loans will be restored to those funds on the same pro rata basis and will not be refunded or carried forward.
3. If a student has to drop a course for which no alternate registration is available, drops special fee courses (music, golf, etc.), or drops a paid audit during the first two weeks of the drop/add period, a full refund may be granted with the approval of the Dean. (The student health fee will not be refunded.)

**Withdrawal Charges and Refunds during Summer Session.** Students who will not be attending a summer term or course(s) for which they have registered must follow the correct procedure and drop the course(s) prior to the first day of the term, even if they have not paid tuition and fees. Failure to drop the course(s) will result in administrative withdrawal from the summer session at the end of the first three days of the term and in billing the student for 20 percent of the tuition plus the health fee. If tuition and fees have been paid for the summer term, the following refund policies apply:

1. When applications for withdrawal from a term or drop of a course are received by the Director of the Summer Session before the first class day of a given term, full tuition and fees will be refunded.
2. When applications for withdrawal are received by the Director during the first three class days, 80 percent of the tuition will be refunded. (The health fee will not be refunded.)
3. When applications for withdrawal from a term or drop of a course are received by the Director after the third class day, there will be no refund of tuition and fees.

**Special Tuition Benefits for Employees.** The Graduate School recognizes a special obligation to encourage the professional and personal advancement of employees. The University thus grants reductions in tuition to eligible employees enrolling in courses offered by the University.

Half-time employees with one or more years of continuous service who receive permission of their supervisors may take up to two courses a semester and will be charged one-half of the tuition rate. This benefit applies *only* to nondegree work. Full-time employees (30 or more hours a week) with two or more years of continuous service who receive permission to take such courses will be charged one-tenth the tuition rate for up

to two courses per semester and will be permitted to audit at no charge. This benefit applies to degree work as well as nondegree. Tuition reduction for undergraduate course work may be considered taxable income and W-2 forms will include the value of the benefit received during the year. Tuition reduction for graduate course work is considered taxable income under current law.

Employees who wish to take graduate classes on a nondegree basis apply through Continuing Education. No Graduate Record Exam is required at this point. If an employee is later admitted into a degree program, up to 12 semester hours of these credits may then be transferred into that program if certain criteria are met (see page 51).

Employees wishing to enroll in a graduate degree program may apply directly to the Graduate School. Since not all of these programs can accommodate part-time study, please make early contact with the appropriate department for advice on your particular educational needs.

Eligible employees should consult the Benefits Office, 705 Broad Street, (919) 684-6723, at least two weeks in advance of payment date to obtain the appropriate tuition voucher.

**Thesis or Dissertation Fees.** Fees incurred in connection with a thesis or dissertation are as follows:

Binding fee, three University copies of thesis or dissertation	\$22.50
Microfilming fee, doctoral degree only, upon final submission	\$40
Copyright fee (doctoral degree only, optional)	\$20

**Athletic Fee.** An athletic fee of \$125 for basketball games is *optional* and payable early in the fall semester.

**Fee for Undergraduate Courses.** Graduate students registering for undergraduate courses will be assessed 3 units for a nonlaboratory course and 4 units for a laboratory course.

**Marine Laboratory Fee.** For Marine Laboratory investigators' research table fee, see the *Bulletin of Duke University: Marine Laboratory*.

**Audit Fee.** Students registered full time during fall and spring may audit courses without charge. Students may not audit activity courses, e.g., physical education, or applied music. Otherwise, audit fees are \$125 per course.

During the summer, students registered for a full course program (two courses) may audit nonlaboratory courses (except physical education activity courses, applied music courses, and studio art courses) with the permission of the instructor and the Director of the Summer Session at no extra charge. Students carrying less than a full course program during the summer may be granted permission by the instructor and the Director to audit a course (above restrictions apply), but must pay half the University tuition charge for the course.

**Vehicle Fee.** Resident students are required to pay an annual fee of \$50 for each motor vehicle or \$25 for each two-wheeled motor vehicle. Resident students registering a vehicle for the first time after January 1 are required to pay \$34 for a motor vehicle or \$17 for a two-wheeled motor vehicle.

If a motor vehicle or a two-wheeled vehicle is removed from the campus permanently and the permit is returned to the traffic office prior to January 20, there will be a refund of \$25 for a motor vehicle and \$12.50 for a two-wheeled motor vehicle.

Students enrolled in the summer session only must also register their motor vehicles with the traffic office. The fee is \$17.50 from May 1 through August 31, or \$7 for each thirty-day period.

**Transcript Fee.** Students who wish to obtain copies of their academic records should direct requests to the Registrar's office. A fee of \$2 is charged for each copy.



**The Student Health Fee.** All full-time students and part-time degree candidates (except those registered *in absentia*) are assessed a fee for the Student Health Service. For the fall and spring, the fee is \$238 (\$119 each semester). For the summer, the fee is \$35 per term. The health fee will be \$29 for each five-week period at the Marine Laboratory.

## Expenses\*

**Housing Fee.** The fee for Town House Apartments, not including utilities, is \$2,067 per occupant for the fall and spring on the basis of two students to a two-bedroom apartment. The fee for modular homes, not including utilities, is \$1,817 per occupant on the basis of three students to a home. Rates in Central Campus Apartments range from \$2,075 per occupant for three students in a three-bedroom apartment to \$3,203 for an efficiency apartment.

Apartments are available during the summer and rates vary according to the type of unit desired and the number of persons occupying the apartment.

Housing fees are subject to change prior to the 1989-90 academic year. A \$100 deposit is required with all applications. Refund on housing fees is made in accordance with the schedules published by the Department of Housing Management. For further information on housing facilities, see the section on living accommodations in the chapter on "Student Life."

**Food.** Food service is described in the section on living accommodations in the chapter on "Student Life." The cost of meals is estimated at an average of \$10.50 per day, or about \$2,460 for the academic year.

**Summary.** The table below represents an estimate of a graduate student's basic expenses during the fall and spring for a full program of work. Miscellaneous items (recreation, travel, clothing, laundry, etc.) will vary according to personal needs and tastes.

Tuition	\$7,680 (24 units)
Registration fee	900
Student health fee	252
Apartment rent (Central Campus Apts.)	2,442
Meals	2,460
Books	780
Miscellaneous (laundry, etc.)	<u>2,336</u>
Total	\$16,850

The estimated cost for one term of the summer session is:

Tuition (two nonlaboratory courses or 6 graduate units)	\$1,596
Registration Fee	100
Student health fee	35
Apartment Rent (Central Campus Apts.)	422
Meals	500
Books and class materials (average)	60
Miscellaneous (laundry, etc.)	<u>203</u>
Total	\$2,916

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\*The figures contained in this section are based on 1988 figures and are subject to change prior to the beginning of the fall 1989 semester.

## Fellowships and Scholarships

**Application Procedure.** Fellowships and scholarships are available to students in most graduate programs. A student who wishes to be considered for any of the following fellowships, scholarships, or assistantships should so indicate on the application form for admission and award. Selection of award recipients is made on the basis of academic merit and departmental recommendations.

While personal financial need may not be the basis for the granting of many graduate awards, the Graduate School requests that all matriculating students (except non-United States citizens) complete the Graduate and Professional Student Financial Aid Service (GAPSFAS) form.

**Satisfactory Progress.** A graduate student is expected to make satisfactory progress in his or her program in order to remain enrolled in a degree program or to receive financial aid. (See "Grades" under the section General Academic Regulations in this chapter). A student is considered to be making satisfactory progress if he or she is eligible to continue during the academic year. Determination of academic load is made at the end of the drop/add period for each semester. If hours are reduced below these levels, the Graduate School Financial Aid Office must be notified and some monies or types of aid may have to be repaid. The student should contact the Financial Aid Office if this situation is contemplated or occurs.

**James B. Duke Fellowships.** The James B. Duke One-Hundredth Anniversary Fund provides fellowships for students who wish to pursue a program leading to the Ph.D. degree in the Graduate School at Duke University. Its objective is to aid in attracting and developing outstanding scholars at Duke. Selection of recipients is made by a faculty committee upon nomination by the appropriate department. These fellowships provide for payment of tuition for full registration during the academic year, plus the registration fee during the summer sessions. They also provide an income stipend of \$1,000 per month for twelve months during the duration of the award. Students entering with baccalaureate degrees may hold this fellowship for three years. Students entering with master's degrees may be fellows for two years. The award requires no service and is renewable each year if the student is satisfactorily progressing toward the degree. The total value of a James B. Duke Fellowship over the three years of tenure for a student who enters Duke with the B.A. degree is over \$60,000 at current tuition rates. There are forty-five James B. Duke fellows currently enrolled.

**Andrew W. Mellon Graduate Fellowships in the Humanities.** As many as six one-year dissertation fellowships are awarded to graduate students in the humanities. Selection of recipients is made by a faculty committee upon recommendation by the appropriate department. These fellowships provide for payment of tuition and health fees plus a monthly stipend.

**Endowed Fellowships.** Other special endowments provide fellowships for graduate study. The Angier B. Duke Fellowship provides support on the same level as the James B. Duke Fellowship for one student for three academic years. There are five Gurney Harris Kearns Fellowships in religion. Selection for these fellowships is made through faculty committees. The E. Bayard Halsted Fellowship in science, history, or journalism is awarded to a graduate of Duke University intending to pursue an advanced degree at Duke. The Frank T. de Vyver Fellowship, administered by the Department of Economics, is awarded each year to an outstanding student entering the doctoral program in economics. The Clare Hamilton Memorial Endowed Fellowship is awarded yearly on the basis of merit and need to one or more outstanding students in clinical psychology. The Charles R. Hauser Fellowship is awarded to an outstanding graduate student in the last year of work toward a Ph.D. degree in organic chemistry. The Calvin Bryce Hoover Fellowship is administered by the Department of Economics and is awarded each year to an outstanding

student entering the doctoral program in economics. The Robert R. Wilson Fellowship in the Department of Political Science is awarded to a student currently enrolled in or entering a doctoral program in international law, international organization, or international relations. The Gertrude Weil Fellowship, administered by the Department of Religion, is awarded to students interested in Judaic studies. The John L. Lievsay Fellowship is awarded to a dissertation-year student in English literature. The Anne McDougall Memorial Award for Women, administered through women's studies, is awarded each year to one woman student studying psychology or a related field.

**Graduate Fellowships.** Graduate fellowships funded by Duke University are available to students in the Graduate School for study during the academic year. Awards, which include tuition, range from \$8,610 to \$15,000.

**Federal Fellowships\*** Duke University participates in the following programs: *National Science Foundation Fellowships.* A number of students hold National Science Foundation Graduate Fellowships which provide tuition plus a stipend of \$12,300.

*Jacob K. Javits Fellows Program.* Five students received the Jacob K. Javits Fellowships in 1987-88. This federal program for students in the humanities provides tuition plus a stipend of up to \$10,000 based on the student's need.

Other federal programs support fellowships, traineeships, and research assistantships through departmental auspices.

**Fellowships in Medieval and Renaissance Studies.** Three fellowships are awarded annually by the Duke University Committee on Medieval and Renaissance Studies. Fellows are chosen from among students enrolled in Ph.D. programs. They receive full tuition, plus a monthly stipend of \$800 for nine months, and may request two renewals of the appointment.

**Special Fellowships.** The following special fellowships are available to qualified Duke students from sources outside the University:

*Shell Fellowships.* Available to students in the social sciences engaged in dissertation research on developing countries. Recipients must be citizens of the United States or permanent residents intending to become United States citizens. The fellowships are designed to cover the expenses of field research in the preparation of doctoral dissertations. The stipend for each fellowship is \$7,000 plus a reasonable amount for transportation expenses. Recipients are chosen competitively from departmental nominees. Inquiries should be made to the Program Coordinator, Center for International Studies, 2122 Campus Drive, Durham, North Carolina 27706.

*Exchange Fellowships with the Free University of Berlin.* Fellowships are available through an exchange arrangement with the Free University of Berlin which will provide funds for one graduate student to study during the regular academic year in Berlin. Interested students should write to the Dean of the Graduate School prior to February 1.

*James B. Duke International Studies Fellowships.* Available to outstanding students from foreign countries who have completed their undergraduate education in institutions outside the United States. Eligibility criteria include concentration in areas broadly defined as international studies, and admission to a Ph.D. program in Duke's Graduate School. Fellowships provide an annual stipend of \$12,000, payable for twelve months, plus tuition and health fees. They are renewable for three years. Recipients are chosen competitively from departmental nominees by a faculty committee. In addition, the program offers a one-year fellowship to an advanced Duke graduate student planning dissertation research abroad in the field of international studies who has passed the preliminary examinations by the time the award begins.

*Frederick K. Weyerhaeuser Forest History Fellowship.* Fellowship is available campus-wide to students who wish to study broadly in the area of forest and conservation history. The annual stipend is \$10,000. Inquiries should be made to the Forest History Society, 701 Vickers Avenue, Durham, North Carolina 27701.

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\*United States citizenship is generally a requirement for eligibility.



**Graduate Fellowships for Minority Students.** A substantial pool of fellowship funds is reserved for the support of minority students, in some instances with a multi-year commitment.

*Duke Endowment Fellowships.* The University has allocated a substantial pool of funds exclusively for the support of U.S. minority students. These awards, called the Duke Endowment fellowships, are made to students who have been nominated by their departments to a central review committee, which considers all nominations and announces the recipients. The fellowships cover tuition and fees and provide a stipend up to \$8,100 for two years if the student has the masters and three years if the student has the baccalaureate degree.

*Presidential Fellowships.* The Presidential Fellowships represent one of Duke's newest initiatives in providing financial support for minority students. These fellowships will be awarded based on academic qualifications to students pursuing the Ph.D. degree in any of 40 programs. These programs range from the basic sciences to the humanities and business. The fellowship covers tuition and provides a stipend for a maximum of three years of support.

*Patricia Roberts Harris Fellowship Program.* This program makes direct fellowship grants available to colleges and universities for the purpose of providing financial support to minority and women graduate and professional students who demonstrate financial need. Duke has received fellowship support through this program and will continue to apply for this support for our graduate departments. The fellowships are funded by the Department of Education and are awarded for up to three years of graduate study.

*The National Consortium for Education Access (NCEA) Fellowship.* The NCEA is a partnership agreement between Historically Black Colleges and Universities, Ph.D.-degree granting institutions and corporations. The goals of the NCEA are (1) to increase the pool of Black Americans holding the Ph.D. degree in disciplines where they are now underrepresented; and (2) to address the underrepresentation of Black faculty in the nation's colleges and universities. The NCEA provides fellowship support for both students and faculty enrolled in a member Ph.D.-granting institution. Students are eligible to receive a minimum of \$3,000 per year, while faculty are eligible for a minimum of \$5,000 per year in assistance. These fellowships are in addition to financial assistance the Ph.D. candidates receive from the participating institution. Students can apply for this fellowship directly through the NCEA by obtaining an application from a member institution or by writing to: Dr. Leroy Ervin, Executive Director, National Consortium for Educational Access, 296 Interstate North Parkway, Suite 100, Atlanta, GA 30339.

**Departmental Fellowships.** Various departments and schools within Duke University have fellowships which are available to students pursuing graduate study. Information may be obtained from the individual departments.

**Graduate Scholarships.** Graduate scholarships funded by Duke University are available to students in many departments of the Graduate School for study during the academic year. Awards are for full or partial payment of tuition; they range in value to \$8,610.

**Alison Bracy von Brock Talent Identification Program Research Fellowship Fund.** This fund will support research in the area of the academically talented, curriculum design and/or teaching methods of the Talent Identification Program. First priority will be given to a Duke University doctoral candidate for postpreliminary examination dissertation research. Second priority shall be given to a qualified postdoctoral candidate to conduct research at Duke University as a visiting fellow under the auspices of the Talent Identification Program. The award will be made for one year with a possible renewal for a second year.

## Assistantships

**Graduate Assistantships.** Appointments as graduate assistants carry a total stipend of up to \$7,500 for the academic year. The value of the stipend is determined by the time

spent in assisting, the qualifications of the assistant, and the nature of the work assigned. Graduate assistants also may receive tuition scholarships in addition to payments for service as an assistant.

**Research Assistantships.** Appointments are available for graduate students whose special training and qualifications enable them to serve as assistants to individual staff members in certain departments. Stipends may be up to \$8,400, depending on the nature of the assistance and the assisting time required.

**Part-time Instruction.** Several departments offering graduate work have exceptionally qualified graduate students work as part-time instructors, tutors, and teaching assistants. Amounts of these assistantships vary and interested applicants should contact their departments directly.

## Payment of Awards

The payment of stipends for graduate assistantships and fellowships starts on September 25 and is made in equal payments on the twenty-fifth day of each month thereafter. Under the Tax Reform Act of 1986, the only graduate student financial assistance exempt from taxation are amounts paid for tuition, fees, books, supplies, and equipment required for course instruction. If services are required for payment of tuition and fees, then that tuition is considered income and is subject to taxation. The graduate school office will supply detailed information.

It is the responsibility of the student to be sure that tuition and fees are paid or that arrangements have been made with the appropriate office or department for submission of tuition payment notices to the Bursar (101 Allen Building). Graduate students should contact either the Director of Graduate Studies in their department or the Graduate School Financial Aid Coordinator (123 Allen Building) depending upon the type of award. Faculty, senior administrative staff, employees, and eligible spouses not in degree programs should contact Harrison Brooke (705 Broad Street) regarding tuition benefits.

## Loans

Students who anticipate a need to supplement their financial resources through loans or college work-study employment must obtain and complete a Graduate and Professional Student Financial Aid Service (GAPSFAS) form. These forms are available at most financial aid offices or from the Financial Aid Coordinator, Graduate School, Duke University, Durham, North Carolina 27706. A student seeking a loan should contact his or her state lending agency.

It is the policy of the Graduate School to provide loans through the University to help students meet their educational expenses. Only students with full-time status who meet the federal criteria for need are eligible for loans. Loan funds are provided through the Carl Perkins Student Loan Program after a student has borrowed the maximum from the Guaranteed Student Loan Program. Generally, loans made from these funds, as is the case with loans from state agencies, bear no interest charge to qualified borrowers while they maintain student status and for a short period thereafter. Interest during the repayment period is at a favorable rate.

Inquiries concerning loans should indicate the department of intended matriculation and include all pertinent information concerning application to a state agency. These inquiries should be addressed to the Financial Aid Coordinator, Graduate School, Duke University, Durham, North Carolina 27706.

## Work-Study Program Employment

Funds are available through the college work-study program for short-term or part-time employment of graduate students. A student who wishes to apply for work-study

must complete a GAPSFAS form. Students considering the possibility of work-study for the fall should submit GAPSFAS forms by April 15. Eligibility requirements are similar to those of the federal loan programs. In addition to departmental employment opportunities, the placement office maintains a listing of employment openings for students.

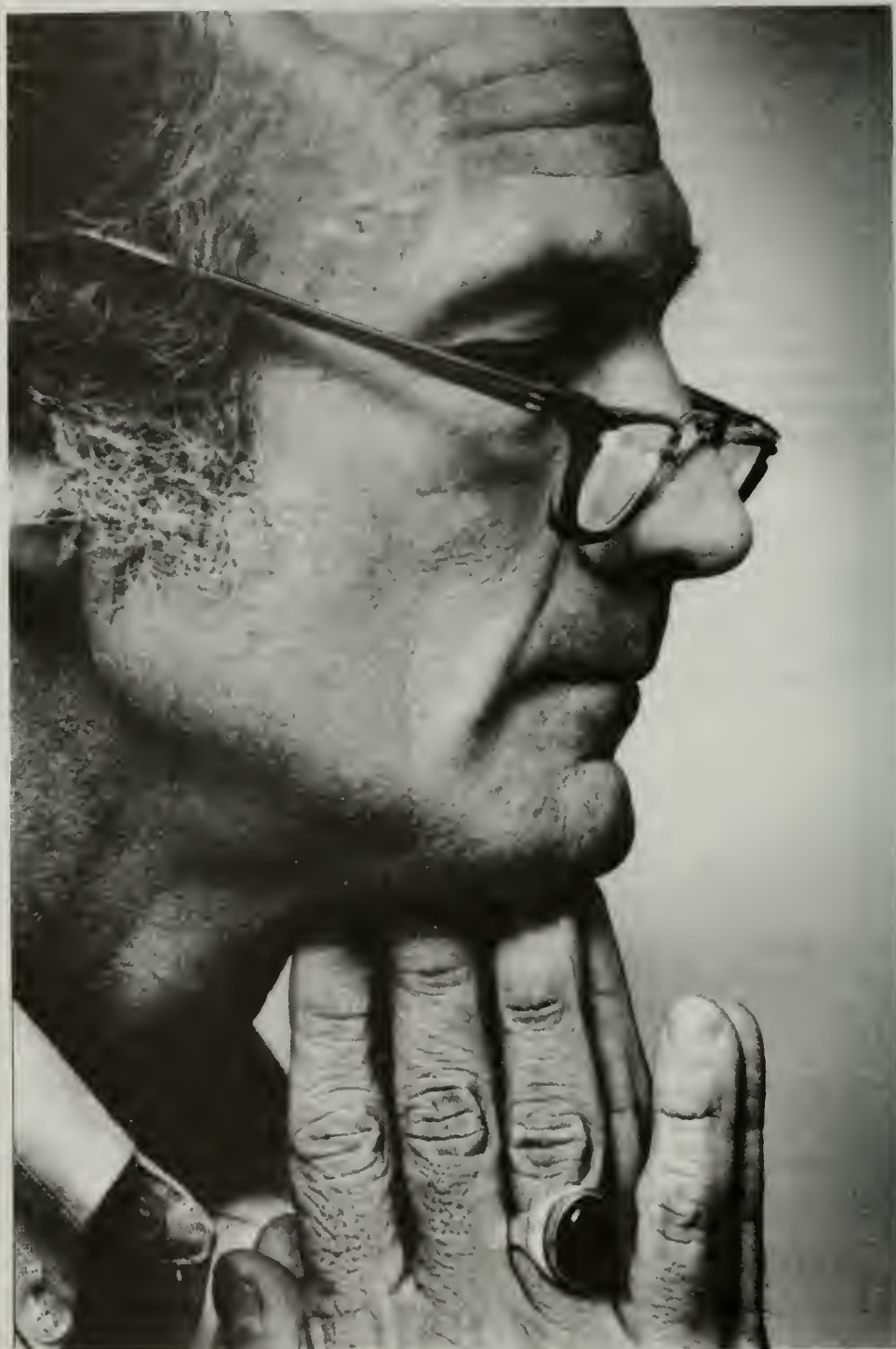
## **Summer Financial Aid**

A limited amount of financial aid is available to students in summer study. Summer financial aid, determined according to demonstrated need, may consist of institutional grant funds and/or low interest loans from the Federally Insured Student Loan program and the Carl Perkins Student Loan program. To qualify for summer school aid, a student must be enrolled or accepted for enrollment at Duke during the academic year immediately preceding the summer for which aid is requested. (Students enrolled only for the summer may be eligible to borrow from outside lenders under the Federally Insured/Guaranteed Loan program in their home states or from the schools at which they are regularly enrolled. They should contact their college's financial aid office or the state's department of higher education for information and applications.) The college work-study aid is determined by the financial aid office based upon the student's financial need and the availability of funds. Graduate awards are determined by departments depending on usual criteria and availability of funds.



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*Registration*



## Registration for Fall 1989

All students must register each fall and spring semester for credit toward their degrees and pay a registration fee each semester unless waived by an approved leave of absence granted by the Dean. Doctoral students are expected to register for 60 units of degree credit. After the 60 units of credit have been achieved, the student will pay only the registration fee each semester until all degree requirements have been met. A master's student (except for those students enrolled in the two-year health administration, physical therapy, and public policy studies programs) will register for a minimum of 30 units of degree credit and for any course units beyond the 30 required of their program. A registration fee is charged each semester.

Approved transfer course work into a master's program will *not* reduce the minimum registration for a master's degree of 30 units at Duke University. Approved transfer of an earned master's degree will reduce the minimum doctoral registration to 45 units of degree credit at Duke University.

Full-time students will register at the rate of either 9 units as teaching or research assistants or 12 units each semester until the minimum units of degree credit have been completed. Part-time students will register for a minimum of 3 units per semester.

Students who are in residence during the summer session, but not enrolled in any courses, pay only the registration fee.

Except for these registration procedures, all other degree regulations remain as stated in the other sections of this bulletin.

All students who enrolled prior to 1985 should consult the bulletin of their year of matriculation for registration procedures and requirements.

Failure to maintain continuous registration each fall and spring semester will result in administrative withdrawal from the University.

**Registration Periods.** All students who are enrolled in the Graduate School and who have not been granted a leave of absence by the Dean must register each fall and spring until all degree requirements are completed. New students will register immediately prior to the first day of classes in either term; continuing students register during the announced preregistration periods in November and March. Students who have been on leaves of absence and who intend to resume a degree program must give the department and the Dean notice of this intention two months before registration.

**Late Registration.** All students are expected to register at the times specified by the University. A late registration fee of \$25 is charged any student registering late, including a current student who delays registering until the registration for new students.

**Change of Registration.** During the first two weeks of the fall or spring semester, registration may be changed with the approval of the Director of Graduate Studies if no reduction of fee is entailed. If fees are to be refunded, the approval of the Dean of the Graduate

School is required. For the succeeding two weeks, courses may be dropped and equivalent hours of ungraded research or residence added with the approval of the Director of Graduate Studies and the Dean.

*Summer Registration.* Students who are in residence at Duke University during the spring and who plan to enroll for courses in the summer session may have their course programs approved by the Director of Graduate Studies during the week of Graduate School registration in March. Course cards for courses or graded research should be submitted to the Office of the Summer Session. Summer session students may register in the summer session office at any time beginning with the March registration period and up to the Wednesday preceding the start of the appropriate term. Graduate students who intend to remain in residence during one or more of the summer session terms without registering for course work must either register for 1 unit of research (students who matriculated prior to fall 1985) or pay a summer registration fee (students who matriculated fall 1985 or later).

Students who are not in residence at Duke during the spring (including newly admitted students to the Graduate School and students of other colleges and universities desiring to earn credits for transfer) may register by mail for the summer session. Advance registration by mail includes:

1. Completion of the summer session application. (Applications may be obtained by writing to the Office of the Summer Session, 121 Allen Building.)
2. Admission to the summer session by the Director of the Summer Session. (Students who have been admitted to the Graduate School for the summer term need not apply to the summer session.)
3. Submission of a properly approved and completed course card in the Office of the Summer Session.

The University does not mail statements for summer session tuition and fees. All tuition and fees should be paid in the Office of the Bursar (101 Allen Building) at least *five full working days* prior to the first day of class (see summer session calendar). Students who fail to register and pay all tuition and fees before this deadline will be assessed a late charge. Failure to pay tuition and fees by the end of the drop/add period will result in administrative withdrawal of the student.

After April 30 all course changes must be approved by the appropriate director of graduate studies. The Director of the Summer Session serves as the dean for all non-Duke students. Course changes are accomplished by submitting the three-part drop/add form to the Office of the Summer Session, 121 Allen Building. Students who are out of town must contact their director of graduate studies directly to arrange for dropping or adding courses.

Summer session students may add a course or courses before or during the first three days of the term. Courses may also be dropped before and during the first three days, but a 20 percent tuition fee will be charged (1) if the course is not dropped before the first day, and (2) the dropped course(s) results in a total tuition reduction. Courses dropped after the third day of classes are not eligible for tuition refund.

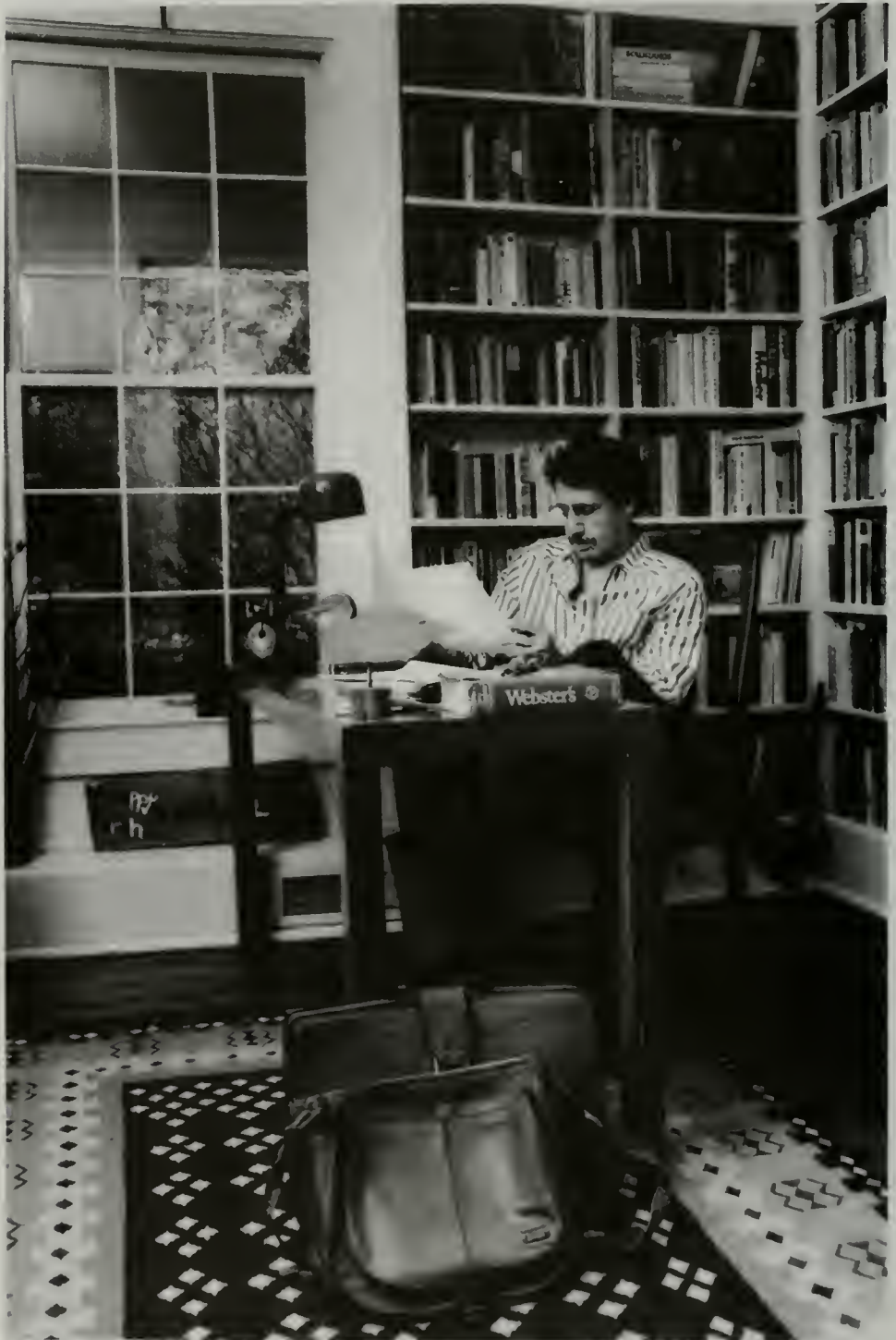
*Additional Registration Requirements.* It is necessary to be a fully registered student according to the regulations listed in the chapter on "Registration" in order to be eligible for library carrel and laboratory space, student housing, University and some outside loans, and the Student Health Service, including accident and sickness insurance. See the chapter on "Student Life."

Part-time graduate students must be enrolled for at least 8 units each semester in order to qualify for loans (National Direct Student Loan, Guaranteed Student Loan).





# Regulations



## General Academic Regulations

**Credits.** The following regulations pertain to credits earned outside the Duke University Graduate School:

*Graduate Credit Earned before the A. B. Degree Is Granted.* Ordinarily no credit will be allowed for graduate courses taken before a student has been awarded the A. B. or B. S. degree. However, an undergraduate student at Duke University, who at the beginning of the final semester lacks no more than three courses in order to fulfill the requirements of the bachelor's degree, may apply for admission to the Graduate School for that final semester. If the student meets the requirements for admission, permission may be obtained from the Dean of the Graduate School to enroll for graduate courses to bring the total program to no more than five courses. In addition to undergraduate registration, the student must register in and pay tuition for those courses to the Graduate School at the beginning of the semester in which graduate credit is to be earned in order for the courses to be credited toward a graduate degree program.

*Transfer of Graduate Credits.* Transfer of credit for graduate work completed at another institution will be considered only after a student has earned a minimum of 12 units of graduate study at Duke University. After completing the 12 units, the student should file a request for transfer of credits on the appropriate Graduate School form.

*Summer Session Credit.* Summer session *credit* does not mean degree credit at Duke University unless the student has been admitted as a degree candidate by one of the colleges or schools of the University. The majority of summer session courses carry 3 units of credit and require one term of residence. A student taking a course for credit is expected to do all the work required and to take the final examination, and will receive a grade. (*G. I. Bill benefits are available only to those veterans who enroll for credit.*)

*Grades.* Grades in the Graduate School are as follows: *E*, *G*, *S*, *F*, and *I*. *E* (excellent) is the highest mark; *G* (good) and *S* (satisfactory) are the remaining passing marks; *F* (failing) is an unsatisfactory grade; and *I* (incomplete) indicates that some portion of the student's work is lacking, *for an acceptable reason*, at the time the grades are reported. For students enrolled in the Graduate School, the instructor who gives an *I* for a course specifies the date by which the student must make up the deficiency. For unclassified graduate students enrolled in the summer session, a temporary *I* for a course may be assigned after the student has submitted a written request. If the request is approved by the instructor of the course, then the student must satisfactorily complete the work prior to the last day of classes of the subsequent summer term. If a course is not completed within one calendar year from the date the course ended, the grade of *I* becomes permanent and may not be removed from the student's record. The grade of *Z* indicates satisfactory progress at the end of the first semester of a two-semester course. A grade of *F* in a major course nor-



mally occasions withdrawal from a degree program not later than the end of the ensuing semester or term; a grade of *F* in any other course occasions academic probation.

**Reciprocal or Interinstitutional Agreements with Neighboring Universities.** Under a plan of cooperation between Duke University and the University of North Carolina at Chapel Hill, North Carolina Central University in Durham, and North Carolina State University at Raleigh, students properly enrolled in the Graduate School of Duke University during the regular academic year, and paying full tuition to this institution, may be admitted to a maximum of two courses per semester at one of the other institutions in the cooperative plan. A Ph.D. student who matriculated prior to fall semester 1985, who has passed the preliminary examination, and who registers for a minimum of 3 units at Duke, may register for 3 to 6 additional units at the other institution. Under the same arrangement, students in the graduate schools in the neighboring institutions may be admitted to course work at Duke University. Credit so earned is not defined as transfer credit. To take advantage of this arrangement during any summer session term, the student registers each term for 3 units of credit at the home institution and 3 units of credit at the other institution, for a total of 6 units. All interinstitutional registrations involving extra-fee courses or special fees required of all students will be made at the expense of the student and will not be considered a part of the Duke University tuition coverage. This reciprocal agreement does not apply to contract programs such as the American Dance Festival.

**Identification Cards.** Graduate students are issued identification cards which they should carry at all times. The card is a means of identification for library privileges, athletic events, and other University functions or services open to them as University students. Students will be expected to present their cards on request to any University official or employee. The card is not transferable, and fraudulent use may result in loss of student privileges or suspension from the Graduate School. A report of the loss of a card must be given immediately to the Registrar's office. The cost of a new ID card is \$5.

**Courses Primarily for Undergraduates.** Students granted provisional admission and others whose preparation is found deficient may occasionally be required, as part of their programs, to take undergraduate courses as prerequisites to continued graduate study. Undergraduate courses thus taken and others elected by the student carry no credit toward a degree.

In exceptional cases, 100-level courses outside the major department may be taken for degree credit to a maximum of two one-semester courses or a one year course not exceeding a total of 8 units, when approved by the Director of Graduate Studies in the major department and in the department in which the course is listed. In order to receive credit for any such undergraduate work, the graduate student must earn a grade of at least *B*.

Under the above conditions, and with the additional approval of the student's department or program, foreign language reading courses numbered above 100 may form a part or all of such degree credit. This provision is effective only for language courses taken after the spring 1988 semester.

**Withdrawal from a Course.** For permissible changes during the first four weeks of the fall or spring semester and during the first three days of summer session term, see the chapter on "Registration." If a course is dropped without the necessary approval, the permanent record will, at the discretion of the Dean of the Graduate School and with the permission of the instructor, list the course as withdrawal error (*WE*). If a course is dropped after the four-week period during the fall or spring or after the first three days of classes during the summer, the status of the student at the time of withdrawal from the course will be determined and indicated on the permanent record as *Withdrew Passing (WP)* or *Withdrew Failing (WF)*.

**Interruption of Program and Withdrawal from the Graduate School.** Students are expected to meet academic requirements and financial obligations, as specified elsewhere

in this bulletin, in order to remain in good standing. Certain nonacademic rules and regulations must be observed also. Failure to meet these requirements may result in dismissal by the appropriate officer of the University.

The University reserves the right, and matriculation by the student is a concession to this right, to request the withdrawal of any student whose academic performance at any time is not satisfactory to the University. A student who wishes for any reason to withdraw from the Graduate School during the fall, spring, or summer session should notify in writing both the Director of Graduate Studies in the major department and the Dean of the Graduate School prior to the date of the expected withdrawal and no later than the published last day of classes for that semester or summer session. If students wish to withdraw from courses in the summer session, they must consult both the Director of Graduate Studies in the major department and the Director of the Summer Session. For refunds upon withdrawal, see the chapter on "Financial Information."

A student who, after successfully completing one semester of graduate study, must withdraw before completion of a graduate program may, with the approval of the major department, request the Dean to issue a certificate of graduate study.

**Leave of Absence.** A leave of absence for a period of time no longer than one calendar year may be granted because of medical necessity, full-time employment, acceptance of an external award judged likely to benefit the student as an individual but not related to the degree requirements, or other acceptable reasons. A request for a leave of absence should be originated by the student, endorsed by the student's major professor and Director of Graduate Studies, and submitted to the Dean of the Graduate School for consideration prior to the beginning of the semester for which the leave is requested. A student is eligible to request a leave of absence only after having completed at least one semester at Duke. Time limitations which pertain to the various degrees and the completion of courses on which a grade of *I* (incomplete) was earned are not waived.

**Language Requirements.** The Graduate School has no foreign language requirement for any of the degrees. Individual departments, however, may require foreign language proficiency. See individual departmental sections in this bulletin or contact the appropriate Director of Graduate Studies to determine specific requirements.

**English as a Second Language.** International graduate students may take advantage of a course designed to familiarize them with the American English sound system and with the structures and expectations of English written discourse. English 200 is neither a remedial course nor a conversational course, but is advanced-level preparation for the papers and presentations required of the graduate student and professional. Additionally, the instructors offer coaching and editing in presentations, written and oral, in weekly conferences. Although English 200 carries three units of credit, these credits will not count toward the minimum registration required for graduate degrees at Duke University.

## Degree Regulations—The Master's Degrees

### MASTER OF ARTS

**Prerequisites.** As a prerequisite to graduate study in the major subjects, a student must have completed a minimum of 24 undergraduate semester hours—ordinarily 12 semester hours of approved college courses in the major subject and 12 semester hours in the major or in related work. Since some departments require more than 12 semester hours in the proposed field of study, students should read carefully the special requirements listed by their major departments in the chapter on "Courses of Instruction." If special master's requirements are not specified in this chapter and there is a question about the prerequisite, prospective students should write directly to the appropriate Director of Graduate Studies.

**Language Requirements.** The Graduate School requires no foreign language for the master's degree. Certain departments, however, do have language requirements and these must be satisfied before the master's examination can be taken. See the departmental listings in the chapter on "Courses of Instruction."

**Major and Related Subjects.** Thirty units of graduate credit at Duke constitutes minimum enrollment for the Master of Arts degree. The students must present acceptable grades for a minimum of 24 units of graded course work, 12 of which must be in the major subject. A minimum of 6 units of the required 24 must be in a minor subject or in related fields which are approved by the student's major department. The remaining 6 units of the required 24 may be taken either in the major or in related fields approved by the major department and the Dean of the Graduate School.

Individual departments decide whether the M.A. program may be completed by submission of an approved thesis or by other academic exercises (see requirements listed in the chapter on "Courses of Instruction"). In either case, a maximum of 6 units may be earned by the completion exercises and the final examination.

**Thesis Requirements.** The thesis should demonstrate the student's ability to collect, arrange, interpret, and report pertinent material on a research problem. The thesis must be written in an acceptable style and should exhibit the student's competence in scholarly procedures. Requirements of form are set forth in the *Duke University Guide for the Preparation of Theses and Dissertations*, copies of which are available in the Graduate School office.

The thesis must be submitted in an approved form to the Dean of the Graduate School on or before April 15 for a May degree, one week before the final day of the Duke University second summer term for a September degree, one week before the final day of the fall semester for a December degree, and at least one week before the scheduled date of the final examination. The copies of the thesis then will be distributed by the student to the several members of the examining committee. Two copies for the library and one copy for the adviser will be bound upon payment of the University binding fee of \$22.50.

**The Examining Committee and the Examination.** The faculty member who directs the student's program recommends an examining committee composed of three members of the graduate faculty, one of whom usually must be from a department other than the major department. If the student has been permitted to take related work within the major department, the third member may be chosen from within the department. Nominations for membership on this committee are submitted for approval to the Dean of the Graduate School at least one week preceding the final examination.

The committee will conduct the examination and certify the student's success or failure by signing the card provided by the Graduate School office. This card indicates completion of all requirements for the degree. If a thesis is presented, the committee members also sign all copies of the thesis, and the candidate then returns the original and first two copies to the Graduate School office.

## MASTER OF SCIENCE

**Prerequisites.** A bachelor's degree is a prerequisite for the M.S. degree. Departments offering an M.S. degree consider for admission students from allied fields provided they have satisfactory scientific and mathematical backgrounds.

**Language Requirements.** There is no foreign language requirement in Master of Science degree programs.

**Major and Related Subjects.** Thirty units of graduate credit at Duke constitutes minimum enrollment for the Master of Science degree. The student must present acceptable grades for a minimum of 24 units of graded graduate courses. Of these, at least 12 units must be in the major subject. A minimum of 6 units must be in a minor subject or in related



fields which are approved by the student's major department. The remaining 6 units of the required 24 may be taken either in the major or in related fields approved by the major department and by the Dean of the Graduate School. A maximum of 6 units may be earned either by submission of an approved thesis, or by completing courses or other academic activities approved by the student's department. As other requirements vary according to department, please consult the chapter on "Courses of Instruction" for further information.

**Thesis and Examination.** Some departments require a thesis; all departments require an examination. The regulations and options for theses and other means of completing the program, as well as the provisions for examination and the examining committee, are the same as the requirements for the Master of Arts degree.

## MASTER OF HEALTH ADMINISTRATION

**Prerequisites.** Students with any undergraduate major may apply. Algebra at the college level is the only prerequisite, and a special course is available each summer for students whose preparation in mathematics is inadequate or out of date.

**Major Subjects.** The Master of Health Administration requires a minimum of 67 units of graduate credit, and the program is normally completed in four semesters.

## Additional Master's Regulations

**Filing the Intention to Receive Degree.** On or before *February 1* for a May degree, on or before *August 1* for a September degree, or on or before *December 1* for a December degree, and at least one month prior to the final examination, the student must file in the Office of the Graduate School, on the official form, a declaration of intention to graduate. The declaration of intention presents the title of the thesis or specifies alternative academic exercises on which the degree candidate will be examined. During their final semester students may not change from a thesis program to a non-thesis program or from a non-thesis program to a thesis program after this form has been filed with the Graduate School Office. The declaration must have the approval of both the Director of Graduate Studies in the major department and the chairman of the student's advisory committee.

**Transfer of Credits.** A maximum of 6 accredited units of graduate credit may be transferred for graduate courses completed at other institutions. Such units will be transferred only if the student has received a grade of *B* (or its equivalent) or better. The transfer of graduate credit does not reduce the required minimum registration of 30 units for a master's degree at Duke. Requests for transfer should be submitted on the approved Graduate School form.

A student who is granted such transfer credit may be permitted to register for as much as 12 units of thesis research instead of the usual 6 units. As another option, a student may take as many as 6 units of further undergraduate training or 6 units of required language courses on the undergraduate level.

**Nondegree Students.** Credit for graduate courses taken at Duke by a student (not undergraduate) before degree admission to the Graduate School or while registered as a non-degree student through the Office of Continuing Education or the Graduate School may be carried over into a graduate degree program if (1) the action is recommended by the student's Director of Graduate Studies and approved by the Dean, (2) the amount of such credit does not exceed 12 units, (3) the work has received grades of *G* or better, (4) the work is not more than two years old, and (5) the student applies for and is granted formal admission into a degree program.

**Time Limits for Completion of Master's Degrees.** Master's degree candidates who are in residence for consecutive academic years should complete all requirements for the degree *within two calendar years* from the date of their first registration in the Graduate School. Candidates must complete all requirements *within six calendar years of their first registration*.

To be awarded a degree in May, the recording of transfer credit must be completed by the first day of the final examination period and all other requirements must be completed by the last day of the final examination period. If a thesis is one of the requirements, it must be submitted to the Graduate School office no later than April 15. Candidates desiring to have their degrees conferred on September 1 must have completed all requirements, including the recording of transfer of credit, by the final day of the Duke University summer session. Candidates completing degree requirements after that date and during the fall will have their degrees conferred on December 30.

## Degree Regulations—The Doctoral Degree

**Requirements.** The formal requirements for the Ph.D. degree are as follows: (1) major and related courses, (2) foreign language(s) in many departments, (3) a supervisory committee for the student's program of study, (4) residence, (5) preliminary examination, (6) dissertation, and (7) final examination.

**Major and Related Work.** The student's program of study demands substantial concentration on courses in the major department. However, a minimum of 6 units in a related field approved by the major department must be included. A few programs have been authorized by the Executive Committee of the Graduate Faculty to utilize courses in fields within the major department in fulfilling the related field requirement. If there are deficiencies in a student's undergraduate program, departments may require certain undergraduate courses to be taken for which the student will not receive degree credit. In all cases the student's supervisory committee will determine if the student must meet requirements above the minimum.

**Foreign Languages.** The Graduate School has no foreign language requirement for the Ph.D. Some departments require two languages; other departments have no foreign language requirements. For specific departmental requirements, see the chapter on "Courses of Instruction" or contact the appropriate Director of Graduate Studies.

Students working toward the doctoral degree in a department requiring a foreign language(s) should complete this requirement by the end of their first year of residence. Those who fail to meet the requirement by the end of their third semester of residence should register in the appropriate special reading course. Any foreign language requirement must be met before the preliminary examination is taken.

**Committee to Supervise the Program of Study.** As early in a student's course of study as is practicable and *not later than two months before the preliminary examination*, the Director of Graduate Studies in the major department will nominate for the approval of the Dean a supervising committee consisting of five members, with one member designated as chairman. This committee will include at least three graduate faculty members of the major department and, usually, at least one from outside the department. For programs in which approval has been granted for related work from a clearly differentiated division within the department, one member of the committee will be chosen from that division. This committee, with all members participating, will determine a program of study and administer the preliminary examination.

**Residence.** The *minimum* residence requirement is one academic year (two consecutive semesters in the same academic year) of full-time registration at Duke (that is, registration of 12 units each semester or, in the case of graduate assistants, 9 units each semes-

ter). The *minimum* registration requirement is 60 units of graduate degree credit, of which not more than 15 units of a completed master's degree may be accepted by transfer. Such transfer of credit will not reduce the minimum requirement of one full-time academic year at Duke.

**Time Limits.** Ordinarily a student registered for full-time study should pass the preliminary examination by the end of the third year. A student who has not passed the examination by the end of this time must file with the Dean of the Graduate School a statement, approved by the Director of Graduate Studies in the major department, explaining the delay and setting a date for the examination. Except under unusual circumstances, extension will not be granted beyond the middle of the fourth year.

The doctoral dissertation should be submitted and accepted within two calendar years after the preliminary examination is passed. Should the dissertation not be submitted and accepted within four years after the examination, the candidate, with the approval of the committee, may petition the Dean of the Graduate School for an extension of up to one year. If this extension is granted and the dissertation is not submitted and accepted by the new deadline, the student will be dropped from candidacy. The student must then pass a second preliminary examination to be reinstated as a candidate for the degree. In such cases, the time limit for submitting the dissertation will be determined by the Dean of the Graduate School and the candidate's committee.

Ordinarily, credit is not allowed for graduate courses (including transfers) or foreign language examinations that are more than six years old at the date of the preliminary examination. Similarly, credit will not be allowed for a preliminary examination that is five years old at the date of the final examination. In cases of exceptional merit, however, the Dean of the Graduate School may extend these limits. Should the five year limits be exceeded, the student's department must submit to the Dean specific requirements for revalidating credits.

**Preliminary Examination.** A student is not accepted as a candidate for the Ph.D. degree until the preliminary examination has been passed. The examination ordinarily covers both the major field and related work. In the summer a preliminary examination may be scheduled only between the opening and closing dates of the summer session.

A student who fails the preliminary examination may apply, with the consent of the supervisory committee and the Dean of the Graduate School, for the privilege of a second examination to be taken no earlier than three months after the date of the first. Successful completion of the second examination requires the affirmative vote of all committee members. Failure on the second examination will render a student ineligible to continue a program for the Ph.D. degree at Duke University.

**The Dissertation.** The dissertation is expected to be a mature and competent piece of writing, embodying the results of significant and original research.

One month before the dissertation is presented and no later than *February 1* preceding the May commencement, *August 1* for a September degree, and *December 1* for a December degree, the student must file with the Dean of the Graduate School, on the official form available in the Graduate School office, the title of the dissertation. This title must receive the written approval of both the Director of Graduate Studies of the student's major department and the professor who directs the dissertation.

The basic requirements for preparing the dissertation (type of paper, form, and binding) are prescribed in the *Guide for the Preparation of Theses and Dissertations*, copies of which are available in the Graduate School office.

The dissertation must be completed to the satisfaction of the professor who directs the dissertation, members of the student's advisory committee, and the Dean of the Graduate School. A copy of the dissertation must be submitted to the Dean of the Graduate School on or before *April 1* preceding the May commencement, one week before the end of the Duke summer session for a September degree, or one week before the end of



the fall semester for a December degree. The dissertation must be submitted to the Graduate School office at least seven days before the scheduled date of the student's examination.

All doctoral dissertations are published on microfilm through University Microfilms, Ann Arbor, Michigan. Authors may copyright them if they wish. Abstracts are published in *Dissertation Abstracts International*.

Two extra copies of the abstract (not more than 350 words long) are submitted when the dissertation is presented to the Graduate School office. A nonrefundable fee of \$40 is charged for microfilming. If copyright is desired, an additional fee of \$20 is charged. The original and two copies will be bound at a cost of \$22.50.

**Final Examination.** The final examination is normally administered by the five members of the supervising committee, but it may be administered by four members of the committee if the member representing the related field is present. In either case, successful completion of the final examination requires at least four affirmative votes. The final oral examination shall be primarily on the dissertation; however, questions may be asked in the candidate's major field. Except in unusual circumstances approved by the Dean, a final examination will not be scheduled when the University is not in session.

A student who fails the final examination may be allowed to take it a second time, but no earlier than six months from the date of the first examination. Permission to take the second examination must be obtained from the professor who directed the dissertation and from the Dean of the Graduate School. Failure to pass the second examination renders the student ineligible to continue work for the Ph.D. degree at Duke University.

**Deposit of the Dissertation.** After passing the examination, candidates bring to the Graduate School office the original and the first two copies of the dissertation, properly signed. At this time they sign the microfilming agreement and pay microfilming and copyright fees.

## Commencement

Graduation exercises are held once a year, in May, when degrees are conferred on and diplomas are issued to those students who have completed requirements by the end of the spring. Those who complete degree requirements by the end of the fall or by the end of a summer term receive diplomas dated December 30 or September 1, respectively. There is a delay in the mailing of September and December diplomas because diplomas cannot be issued until they are approved by the Academic Council and the Board of Trustees.

## Standards of Conduct

Duke University expects and will require of all its students cooperation in developing and maintaining high standards of scholarship and conduct.

Students are expected to meet academic requirements and financial obligations, as specified elsewhere in this bulletin, in order to remain in good standing. Certain nonacademic rules and regulations must be observed also. Failure to meet these requirements may result in dismissal by the appropriate officer of the University.

The University wishes to emphasize its policy that all students are subject to the rules and regulations of the University currently in effect or which, from time to time, are put into effect by the appropriate authorities of the University. Students, in accepting admission, indicate their willingness to subscribe to and be governed by these rules and regulations and acknowledge the right of the University to take such disciplinary action, including suspension and/or expulsion, as may be deemed appropriate for failure to abide by such rules and regulations or for conduct adjudged unsatisfactory or detrimental to the University. University authorities will take action in accordance with due process.

Duke University, as a community of scholars, strongly relies upon the standard of academic integrity. Plagiarism and other forms of academic dishonesty represent a corruption of this integrity and, as such, cannot be tolerated within the community. Ignorance of what constitutes academic dishonesty is no excuse for actions which violate the integrity of the community. In a community which builds on the notion of academic integrity, the threat of academic dishonesty represents an intolerable risk. Students unsure about the university definition of plagiarism may wish to consult the *Bulletin of Duke University: Information and Regulations* (especially the chapter on “Academic Honesty”).

**Sexual Harassment Procedures.** A committee of students, faculty, and administrators exists at Duke to respond to concerns about sexual intimidation in any form. For confidential assistance and information on procedures, contact Professor Kate Bartlett (law), 684-6946, or Dr. Judith Ruderman (Continuing Education), 684-6259.

**Student Discrimination Grievance Procedures.** It is the responsibility of the Director of Graduate Studies to inform each graduate student of the appropriate channels of redress. In normal circumstances, the Director of Graduate Studies is the first to hear the complaint. If the complaint cannot be resolved satisfactorily at this level, the student may address, in turn, the department chairman, the Associate Dean of the Graduate School, the Dean of the Graduate School, the Provost, and as a last resort, the President of the University.

**Judicial Code and Procedures.** In the spring of 1971, the Graduate School community ratified and adopted the following official judicial code and procedures:

#### I. Graduate School Judicial Code and Procedures

A. A student, by accepting admission to the Graduate School of Duke University, thereby indicates willingness to subscribe to and be governed by the rules and regulations of the University as currently are in effect or, from time to time, are put into effect by the appropriate authorities of the University, and indicates willingness to accept disciplinary action, if behavior is adjudged to be in violation of those rules or in some way unacceptable or detrimental to the University. However, a student’s position of responsibility to the authorities and the regulations of the University in no way alters or modifies responsibilities in relation to civil authorities and laws.

B. A graduate student at Duke University stands in a primary and unique relation of responsibility to the faculty in the major department, the faculty upon whose recommendation a graduate degree will or will not be awarded to the student. In matters which involve or may affect the student’s intellectual or professional life, the student is directly responsible to this department and its representatives, and such matters should primarily be handled by the department.

C. Actions which appear to conflict with University-wide rules and regulations will fall under the jurisdiction of the University Judicial Board.

D. A student may elect to have the Dean of the Graduate School hear matters related to the student’s conduct in addition to or instead of faculty members from the student’s major department, or may elect to have such matters reviewed and judged by a judicial board instead of the Dean of the Graduate School or members of the faculty in the major department. (The constitution and procedure of the judicial board are detailed below.)

E. The Director of Graduate Studies in the student’s major department may request that a student’s actions be reviewed by the Judicial Board or by the Dean of the Graduate School.

#### II. The Graduate School Judicial Board

A. *Composition.* The Graduate School Judicial Board shall have five members, serving for a period of two years: two students selected from the student body, two members of the Graduate Faculty appointed by the Executive Committee of the Graduate School, and one Associate or Assistant Dean appointed by the Dean of the Graduate School. The Board shall elect one of its members as Chairman. The Board shall have at its service a recording secretary to keep minutes of the hearings and of the Board’s actions in a permanent, confidential record book. The Board will be constituted in order to hear cases in which the accused is a student currently enrolled in the Graduate School and which have been referred to it by the Director of Graduate Studies in the student’s department, by the Dean of the Graduate School, or by the student himself.

B. *Preliminary Procedures.* If a student requests a hearing by the Judicial Board it must be done in writing, allowing its Chairman at least seventy-two hours to convene the Board. In addition, the Chairman shall not convene the Board until seventy-two hours after being asked to convene the Board. It is the responsibility of the Chairman of the Judicial Board fully to inform its members concerning the case and the reasons the case has been referred to the Board; and to prepare a written summary of this information for the Board, the Dean, and the student.

C. *Procedural Safeguards for the Hearing.* The Accused has the right to challenge any member of the Judicial Board on grounds of prejudice. If the Board decides to excuse one or more of its members for reasons given by the Accused, it shall consult with the Dean about the need for replacements. The Accused may choose an Adviser to assist in the defense. The Accused may also produce witnesses (including no more than two character witnesses), introduce documents, and offer testimony. A person having direct knowledge relevant to a case being heard by the Board is a material witness. The Judicial Board may request the appearance of material witnesses. The Board shall also request, upon written request of the Complainant or the Accused, the appearance of material witnesses. Witnesses shall be notified of the time, place, and purpose of their appearance. The Accused has the right to examine the written statement of any witness relevant to the case at least seventy-two hours before the hearing. The Accused has the right to be faced with any witness who has given a statement relevant to the case at the hearing if the witness's attendance can be secured.

The hearing will be conducted in private unless the Accused requests an open hearing. If any objection is raised to conducting an open hearing in any particular case, the Judicial Board shall decide the issue by majority vote. If the decision is made not to hold an open hearing, the Accused shall be informed in writing of the reasons for the decision.

The Judicial Board shall consider only the report of the Chairman, documents submitted into evidence, and the testimony of witnesses at the hearing in reaching its decisions.

D. *Conduct of the Hearing.* The hearing of any case shall begin with a reading of the charge by the Chairman in the presence of the Accused. The Accused shall then plead guilty or not guilty or move to terminate or postpone the hearing. The Accused may qualify a plea, admitting guilty in part and denying it in part. The Accused may not be questioned for more than one hour without recess.

At any time during the hearing, the Accused or the Judicial Board may move to terminate or to postpone the hearing or to qualify the plea or to modify its charge.

Pending verdict on charges (including appeal) against the Accused, status as a student shall not be changed, nor the right to be on campus or to attend classes suspended, except that the Chancellor or Provost may impose an interim suspension upon any member of the University community who demonstrates, by conduct, that continued presence on the campus constitutes an immediate threat to the physical well-being or property of members of the University community or the property or orderly functioning of the University.

E. *Sanctions and the Verdict.* The Graduate School Judicial Board shall have the power to impose the following penalties: expulsion, dismissal from the University with the recommendation that the person never be readmitted; suspension, dismissal from the University and from participation in all University activities for a specified period of time, after which the student may apply for readmission; disciplinary probation, placing the student on a probationary status for a specified period of time, during which conviction for violation of any regulation may result in more serious disciplinary action; restitution, payment for all, or a portion of property damage caused during the commission of an offense. Restitution may be imposed by itself or in addition to any of the other penalties. The Judgment shall consist of a finding of guilty or not guilty of the charge and, when the Accused is found guilty, a statement of the punishment assessed. On all questions, including the verdict and the finding of guilty or not guilty, the Board shall be governed by a majority vote. The Judicial Board may decide to rehear a case in which significant new evidence can be introduced. In addition, the defendant may request an appeal.

F. *Appeals.* The appellant may submit to the Dean a written statement containing the grounds for appeal and arguments. In such cases, the Dean should determine if the appeal should be granted, and the Dean can hear the case, or refer it to the appropriate faculty in the student's department or to the Judicial Board.

An appeal shall be granted on the following grounds: procedural error substantially affecting the rights of the accused; incompatibility of the verdict with the evidence; excessive penalty not in accord with "current community standards;" new evidence of a character directly to affect the judgment but on which the original tribunal had refused a new hearing.

### III. Amendment and Construction

This Judicial code and procedure and this constitution and procedure for the Graduate School Judicial Board may be amended at any time with due notice or publication by consent of the Dean, the Executive Committee, and the graduate students. Questions and problems not answered or anticipated by the foregoing may be resolved by the use of other existing institutions or by amendment.





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*Courses of Instruction*



## Course Enrollment

Courses numbered 200-299 are sometimes open to qualified undergraduate students who have received permission of the instructor and the Director of Graduate Studies. Undergraduate students are not permitted in any courses above 300.

In general, courses with odd numbers are offered in the fall semester, those with even numbers in the spring semester. Double numbers separated by a hyphen indicate that the course is a year course and usually must be continued throughout the year if credit is to be received. A student must secure written consent from the instructor in order to receive credit for either semester of a year course. Double numbers separated by a comma indicate that although the course is a year course, credit may be received for either semester without special consent. Ordinarily, courses which bear no date are offered every year.

In each department the number 399 is reserved to designate special (individual) readings in a specified area and supervised by a regular member of the graduate staff, with credit of 1-3 units each registration, only one course per registration, and 9 units maximum in three successive registrations. The course is restricted to resident master's and doctoral programs, must have a completion exercise, and must carry a grade.

The symbol *S*, suffixed to a course number, identifies that course as a seminar.

## Art and Art History

Professor Spencer, *Chairman and Director of Graduate Studies* (112A East Duke); Associate Professors Bruzelius and Wharton; Assistant Professors Castriota, Cernuschi, Stiles, Sund, and van Miegroet; Professor Emeritus Markman

Graduate work in the Department of Art and Art History is offered leading to the A.M. degree in art history and is designed to provide basic training in the history of art with specialization in a given field selected by the student after consultation with and approval by the Director of Graduate Studies. Prospective students should present a minimum of 24 semester hours of undergraduate work in the history of art. In special cases a student who does not fulfill this prerequisite may be required to attend prescribed undergraduate courses. A reading knowledge of one foreign language (preferably German) is required; candidates who do not meet this requirement upon admission to the program are expected to do so by the end of their first term in residence.

The program for the A.M. degree in art history consists of 30 units as follows: 12 units in art history; 6 units in an approved minor; 6 units in the major or minor, or other approved subject; and 6 units in thesis. A written thesis is required.



## For Seniors and Graduates

**220S. Studies in Greek Art.** Specific aspects of the art or architecture in the Greek world from the late geometric to the Hellenistic periods. Subject varies from year to year. Prerequisite: consent of instructor. C-L: Classical Studies 220S. 3 units. *Castriota*

**221S. Studies in Roman Art.** Selected topics in the art and architecture of Late Republican and Imperial Rome. Prerequisite: consent of instructor. C-L: Classical Studies 227S. 3 units. *Castriota*

**222S. Greek Sculpture.** See C-L: Classical Studies 231S. 3 units. *Stanley*

**223S. Greek Painting.** See C-L: Classical Studies 232S. 3 units. *Stanley*

**224S. Greek Architecture.** See C-L: Classical Studies 233S. 3 units. *Richardson*

**225S. Roman Architecture.** See C-L: Classical Studies 235S. 3 units. *Richardson*

**226S. Roman Painting.** See C-L: Classical Studies 236S. 3 units. *Richardson*

**230S. Medieval and Byzantine Art and Architecture.** Conceptual, institutional, or stylistic topics. Subject varies from year to year. Prerequisite: consent of instructor. C-L: Classical Studies 230S and Medieval and Renaissance Studies. 3 units. *Bruzelius or Wharton*

**232S. Romanesque and Gothic Art and Architecture.** Analysis of an individual topic. Subject varies from year to year. Prerequisite: consent of instructor. C-L: Medieval and Renaissance Studies. 3 units. *Bruzelius*

**234. Medieval Architecture.** The development of medieval architecture through the mid-fourteenth century. Emphasis on churches, with some discussion of castles and fortifications, town planning, and domestic architecture. C-L: Medieval and Renaissance Studies. 3 units. *Bruzelius*

**235. Gothic Cathedrals.** Major monuments of Gothic architecture in the twelfth and thirteenth centuries on the continent and in England with concentration on the great cathedrals of France. 3 units. *Bruzelius*

**241. Fifteenth-Century Italian Art.** Painting, sculpture, and architecture from Masaccio, Donatello, and Brunelleschi to Leonardo. Emphasis on the art of Florence. 3 units. *Spencer*

**242S. Studies in Italian Renaissance Art.** Specific problems dealing with iconography, style, or an individual master from ca. 1300 to 1600. Subject varies from year to year. Prerequisite: consent of instructor. C-L: Medieval and Renaissance Studies. 3 units. *Spencer*

**243S. Studies in Northern Art.** Selected topics such as the Antwerp workshops of the sixteenth century, picturing in Haarlem at the turn of the seventeenth century, or Rubens and Rembrandt. C-L: Medieval and Renaissance Studies. 3 units. *van Miegroet*

**251. Italian Baroque Art.** Seventeenth-century painting, sculpture, and architecture. 3 units. *Staff*

**252. Northern Baroque Painting.** Seventeenth-century Flemish and Dutch painting, with emphasis on the art of Rubens and Rembrandt. 3 units. *van Miegroet*

**261S. Studies in Romanticism.** Examination of the work of a single artist or the development of a specific theme or movement within the period 1760 to 1850. 3 units. *Staff*

**262S. Studies in Nineteenth-Century Art.** Focus on a major artist, movement, or trend in nineteenth-century art. Prerequisite: consent of instructor. 3 units. *Sund*

**274. The History of Impressionism.** The evolution of the impressionist movement and the works of its major masters. Particular attention will be paid to Monet, Degas, Cézanne, Pissarro, and Renoir. 3 units. *Sund*

**275. Surrealism.** The surrealist movement that flourished in Paris between the World Wars; its origins, aims, and major adherents—such as the artists Miró, Magritte, Tanguy, and Dali—examined in the context of surrealist literature, theory, and politics. 3 units. *Sund*

**276S. Problems in Modern Art.** Selected topics in modern art before 1945, with emphasis on major movements or masters. Prerequisite: consent of instructor. 3 units. *Cernuschi, Stiles, or Sund*

**277S. Contemporary Art.** Historical and critical principles applied to present-day artists and/or movements in all media since World War II. Prerequisite: consent of instructor. *Cernuschi or Sund*

**278. Twentieth-Century Criticism.** Twentieth-century art through the writings of its major proponents from Apollinaire and Roger Fry through Meyer, Schapiro, and Clement Greenberg to present-day theorists of postmodernism. The definition of modernism and the role of the critic as advocate, mediator, arbiter, and prophet of contemporary trends. 3 units. *Staff*

**282S. Contemporary Theory in the Visual Arts.** Theory in contemporary history and its accommodation to theoretical developments in other disciplines (for example, literature, women's studies, Marxism, and anthropology). Focus on the writings of contemporary, theory-centered art historians and critics. Prerequisite: consent of instructor. 3 units. *Wharton*

**293S. Methodology of Art History.** Approaches to the study and theory of art: historiography, connoisseurship, iconology, and criticism. Prerequisite: consent of instructor. 3 units. *Staff*

**294, 295. Special Problems in Art History.** Individual study and research. 6 units. *Staff*

## COURSES CURRENTLY UNSCHEDULED

**227. Early Christian Culture: Evidence of Art and Literature**

**231. Byzantine Art and Architecture**

**245. Sixteenth-Century Italian Art**

**248. Art of Northern Europe in the Fifteenth and Sixteenth Centuries**

**249. Death in Art**

**279S. Problems in Modern Architecture**

## Asian Languages

The courses are offered as an enrichment for students interested in the South Asian subcontinent and may be taken as a general elective by advanced undergraduate students. No major work is offered in Hindi-Urdu.

## COURSES CURRENTLY UNSCHEDULED

**Hindi-Urdu 200, 201. Special Studies in South Asian Languages**

For courses in Chinese and Japanese, see *Bulletin of Duke University: Undergraduate Instruction*.

## Biochemistry

Professor Hill, *Chairman* (255 Nanaline H. Duke); Professor Webster, *Director of Graduate Studies* (157-B Nanaline H. Duke); Professors Bell, Bennett, Fridovich, Gross, Kredich, Lefkowitz, McCarty, Modrich, Rajagopalan, Siegel, and Spicer; Associate Professors Greene, Greenleaf, Hsieh, B. Kaufman, D. Richardson, Sage, Steege, and Sullivan; Assistant Professors Been, Blackshear, Fierke, Hershfield, R. Kaufman, and Schlossman; Professor Emeritus Bernheim; Associate Medical Research Professor J. Richardson

Graduate work in the Department of Biochemistry is offered leading to the Ph.D. degree. Preparation for such graduate study may take diverse forms. Undergraduate majors in chemistry, biology, mathematics, or physics are welcome, but adequate preparation in chemistry is essential. Graduate specialization areas include protein structure and function, crystallography of macromolecules, nucleic acid structure and function, lipid biochemistry, membrane structure and function, molecular genetics, and enzyme mechanisms. The biochemistry department, in cooperation with the University Programs in Genetics and in Cell and Molecular Biology, offers biochemistry students the opportunity to pursue advanced research and study to fulfill the requirements for the Ph.D. degree related to these fields.

**200. General Biochemistry.** An introductory survey of fundamental aspects of biochemistry with emphasis on the structure of macromolecules, mechanism of enzyme action, metabolic pathways, biochemical genetics, and the structure and functions of special tissues. Designed for medical students; graduate students only with consent of instructor. 4 units. *Hill and staff*

**209, 210. Independent Study.** A tutorial designed for students who are interested in either a laboratory or a library project in biochemistry. C-L: Marine Sciences. Credit to be arranged. *Staff*

**215. Genetic Mechanisms.** Genetic mechanisms in molecular terms emphasizing gene function, segregation, and regulation in prokaryotes and eukaryotes. Systems covered include bacterial viruses, bacteria, plasmids, cellular organelles, and selected lower and higher eukaryotes. Course material will be drawn from original literature. Prerequisite: introductory biochemistry. C-L: The University Program in Genetics. 3 units. *Webster and staff*

**219. Molecular and Cellular Bases of Differentiation.** See C-L: Cell Biology 219; also C-L: Microbiology and Immunology 219 and Pathology 219. 3 units. *Counce and staff*

**219S. Seminar.** Optional seminar in conjunction with Biochemistry 219. *McCarty*

**222. Structure of Biological Macromolecules.** Introduction to the techniques of structure determination by X-ray crystallography and study of some biological macromolecules whose three-dimensional structures have been determined at high resolution. 2 units. *Richardson*

**224. Biochemistry of Development and Differentiation.** The course represents an extension of topics covered in the first semester course, Biochemistry 219. Emphasis will be on the control of transcription and translation of messenger RNA in mammalian cells. These studies include gene amplification, postsynthetic modifications of chromosomal proteins, as a result of hormone induction. Specific systems will include the development of the mammary gland, the pancreas, and the chick oviduct. 2 units. *McCarty*

**227. Introductory Biochemistry I: Intermediary Metabolism.** Chemistry of the constituents of proteins, lipids, carbohydrates, and nucleic acids and their metabolic interrelationships. Prerequisite: organic chemistry. 3 units. *Fridovich and Rajagopalan*



**259. Molecular Biology I: Protein and Membrane Structure/Function.** Detailed concepts of the structure and function of proteins as enzymes and as structural elements of cellular substructures, including: protein primary structure and its determination, patterns of protein folding, mechanisms of enzyme catalysis and regulation, function and formation of multimeric protein assemblies, proteins and other constituents of biological membranes. Prerequisite: introductory biochemistry or consent of instructor. C-L: The University Program in Cell and Molecular Biology, Cell Biology 259, and Microbiology and Immunology 259. 3 units. *Erickson and staff*

**265S, 266S. Seminar.** Topics and instructors announced each semester. C-L: Marine Sciences 266S. 2 units or variable. *Staff*

**268. Molecular Biology II: Nucleic Acids.** Structure and metabolism of nucleic acids in the context of their biological function in information transfer. Prerequisites: introductory biochemistry, Biochemistry 259, or consent of instructor. C-L: The University Program in Cell and Molecular Biology, Cell Biology 268, The University Program in Genetics, and Microbiology and Immunology 268. 4 units. *Modrich and staff*

**286. Current Topics in Immunology.** Introduction to some biochemical aspects of modern immunology. Primary focus on the structure of antibodies and T-cell receptors, their interaction with antigens, and mechanisms which generate their diversity. Other topics include the differentiation of B- and T-cells and the effect of lymphokines on these processes, and immunochemical methods and their application to biochemical problems. 2 units. *Sage*

**288. The Carbohydrates and Lipids of Biological Systems.** The subjects will be considered in the following two general categories: (a) the relationship between chemical structure and biological function and (b) biosynthesis and catabolism. 2 units. *Kaufman*

**291. Physical Biochemistry.** Principles of thermodynamics, hydrodynamics, spectroscopy, and X-ray diffraction and scattering are applied to biological systems. Biological molecules and macromolecules in both soluble and crystalline states are discussed. Prerequisite: undergraduate physical chemistry, including solution thermodynamics, kinetics, introductory quantum mechanics, and introductory crystallography. 3 units. *Hsieh and staff*

**297. Intermediary Metabolism.** Lectures and student presentations on selected topics in the areas of metabolic regulation, bioenergetics, and other subjects of current research interest in metabolism. 3 units. *Siegel and staff*

**345, 346. Biochemistry Seminar.** Required of all biochemistry students. 1 unit each. *Hill*

## COURSES CURRENTLY UNSCHEDULED

245L. Macromolecules, Ecology, and Evolution

276. Comparative and Evolutionary Biochemistry

296. Biological Oxidations

299. Nutrition

## Biological Anthropology and Anatomy

Professor Kay, *Chairman* (254 Sands); Associate Professor Smith, *Director of Graduate Studies* (256 Sands); Professors Cartmill, Hylander, Simons, and Terborgh; Associate Professors Glander and van Schaik; Assistant Professors Bassett, Roth, and Wright; Associate Professor Emeritus Duke; Visiting Assistant Professor White

Students will be accepted for the Ph.D. degree. Admission to the program is not contingent on any particular course of study at the undergraduate level. The goal of the graduate program in biological anthropology and anatomy is to provide students with a broad-based background in organismal biology with which to study the behavior, ecology, and evolution of primates. The three general areas of specialization in the department are: (1) behavior, physiology, and ecology; (2) paleontology, systematics, and evolution; and (3) functional, comparative, and developmental morphology. Students are encouraged to define a course of study that crosses these boundaries and that extends beyond the strict limits of primatology. Research opportunities include behavioral research at the Duke University Primate Center; ecological fieldwork in South America, Asia, and the Malagasy Republic; paleontological fieldwork in Africa, South America, North America, and the Malagasy Republic; and laboratories in experimental functional morphology and comparative embryology.

Courses of study are tailored to meet individual needs, but all students will be expected to take gross human anatomy, a course in statistics and experimental design, and at least one course in each of the subfields of the department. Students are required to demonstrate a reading knowledge of at least one language other than English. Further details are available in the *Guide to the Graduate Program in Biological Anthropology and Anatomy*, available from the Director of Graduate Studies.

**238. Functional and Evolutionary Morphology of Primates.** History and functional significance of locomotor and feeding adaptations, craniofacial morphology, sense organs, and reproductive systems in primates, including *Homo sapiens*. Prerequisite: consent of instructor. 3 units. *Staff*

**244S. Primate Behavior.** Social behavior of prosimians, monkeys, and apes and the evolutionary development of primates. 3 units. *Glander*

**246S. The Primate Fossil Record.** Evolution of humans and other primates as inferred from fossil remains. Prerequisite: a course in human evolution. 3 units. *Simons*

**280S, 281S. Seminar in Selected Topics.** Special topics in methodology, theory, or area. Prerequisite: consent of instructor. 3 units each. *Staff*

**292S. Topics in Morphology and Evolution.** Various aspects of vertebrate morphology and evolution, including major historical approaches to the interpretation of morphology; the evolution, development, and function of specific morphological structures; and patterns of vertebrate evolution. Prerequisite: consent of instructor. 1-3 units. *Smith*

**301. Anatomy of the Limbs.** The musculoskeletal anatomy of the limbs and limb girdles. Emphasis is on detailed dissection of the extremities, with a minor focus on clinical applications. Course primarily intended for advanced graduate students in physical therapy. Prerequisite: consent of instructor. 1-3 units. *Staff*

**305. Gross Human Anatomy.** Includes complete dissection of a cadaver; laboratory work is supplemented by conferences which emphasize biological and evolutionary aspects. Prerequisites: adequate background in biology, including comparative anatomy and embryology and written consent of instructor. Required of entering graduate students in anatomy; by arrangement, may extend into second semester. 3 units. *Staff*

**312. Research.** Individual investigations in the various fields of biological anthropology and anatomy. Prerequisite: consent of instructor. Credit to be arranged; maximum 6 units. *Staff*

**313. Anatomy Seminar.** Regular meeting of graduate students and staff in which current research problems in anatomy will be presented. 1 unit each. *Staff*

**314. Biological Anthropology Seminar.** Regular meeting of graduate students and staff in which current research problems in biological anthropology will be presented. 1 unit each. *Staff*

**334. Topics in Physical Anthropology.** 3 units. *Staff*

**340. Tutorial in Advanced Anatomy.** Topics for intensive reading and discussion will be chosen according to the student's interests, related to basic problems in function of bone and muscle systems, development and differentiation, comparative anatomy at the gross and histological level and vertebrate evolution. Prerequisite: consent of instructor. Variable units. *Staff*

**354. Research in Biological Anthropology and Anatomy.** A preceptorial course in various research methods in biological anthropology and anatomy. Prerequisite: consent of instructor. Credit to be arranged. *Staff*

## Botany

Professor W. Culberson, *Chairman* (149 Biological Sciences); Professor Schlesinger, *Director of Graduate Studies* (145 Biological Sciences); Professors Antonovics, Boynton, Christensen, Osmond, Ramus, Searles, Siedow, Stone, Strain, White, and Wilbur; Associate Professor Knoerr; Assistant Professors Johnston, Kohorn, Mishler, and Vilgalys; Professors Emeriti Anderson, Billings, Hellmers, Kramer, Naylor, and Philpott; Adjunct Professor C. Culberson; Adjunct Associate Professor Patterson

Graduate work in the Department of Botany is offered leading to the A.M. (nonthesis), M.S. (thesis), and Ph.D. degrees. Students entering the graduate program in botany normally have a broad background in the botanical or biological sciences supplemented with basic courses in chemistry, mathematics, and physics. Biochemistry and physical chemistry are strongly recommended for students interested in molecular areas, and advanced courses in mathematics are recommended for students in population genetics and ecology. Deficiencies may be corrected by taking appropriate courses during the first year of graduate study.

Students in botany may specialize in a wide variety of areas including anatomy; cellular and molecular biology; evolution; developmental, ecological, molecular, organelle, and population genetics; physiology; community, ecosystem, physiological, and population ecology; marine biology; and the systematics of algae, fungi, lichens, bryophytes, ferns, and flowering plants. Students' programs are tailored to individual needs. A brochure providing detailed information on the botany department is available from the Director of Graduate Studies.

**205. Molecular Biology.** Molecular aspects of gene expression and cell differentiation; application of recombinant DNA techniques to basic and applied problems. Prerequisites: cell biology and/or genetics or consent of instructor. 3 units. *Johnston*

**210L. Bryology.** Morphological, systematic, and ecological characteristics of mosses and liverworts. 3 units. *Mishler*

**212L. Phycology.** Morphological and ecological characteristics of common freshwater and marine algae and principles of their classification. 3 units. *Searles*

**217L. Biology of Marine Macrophytes.** Physiology and ecology of seaweeds, seagrasses, marshgrasses, and mangroves. Biological flux of carbon and nutrients in coastal seas. Ecological consequences of photosynthetic adaptations. Prerequisites: introductory biology and chemistry. Given at Beaufort. C-L: Marine Sciences 217L. 4 units. *Ramus*

**218. Barrier Island Ecology.** Adaptation of plants to barrier island migration and other physical characteristics of the coastal environment. Major emphasis will be placed on management of barrier beaches from Maine to Texas and the impact of human interference with natural processes. Field studies. Prerequisite: a course in general ecology. Given at Beaufort. C-L: Forestry and Environmental Studies 218 and Marine Sciences 218. 6 units. *Staff*



**219L. Benthic Marine Algae.** Morphology, reproduction, life histories, systematics, and natural history of seaweeds. Lectures, laboratories, and fieldwork in ocean and estuaries. Prerequisite: introductory biology; plant diversity recommended. C-L: Marine Sciences 219L. 4 units. *Schneider (visiting summer faculty)*

**220L. Mycology.** Survey of the major groups of fungi with emphasis on life history and systematics. Field and laboratory exercises. 3 units. *Vilgalys*

**221S. Topics in Advanced Mycology.** Current research on fungal evolution, genetics, physiology, and ecology. Prerequisites: Botany 220L or consent of instructor. 3 units. *Vilgalys*

**224T, 225T. Special Problems.** Students with adequate training may do special work in the fields listed below. Credit to be arranged. 1 to 4 units.

1. Genetics. *Antonovics*
2. Genetics. *Boynton*
3. Ecology. *Christensen*
4. Lichenology. *W. Culberson*
5. Molecular Botany. *Johnston*
6. Cell Biology. *Kohorn*
7. Bryology and Systematics. *Mishler*
8. Physiological Ecology. *Osmond*
9. Phycology. *Ramus*
10. Ecology. *Schlesinger*
11. Phycology. *Searles*
12. Physiology. *Siedow*
13. Systematics of Flowering Plants. *Stone*
14. Ecology. *Strain*
15. Mycology and Molecular Systematics. *Vilgalys*
16. Anatomy and Morphology of Vascular Plants. *White*
17. Systematics of Vascular Plants. *Wilbur*

**232. Microclimatology.** See C-L: Forestry and Environmental Studies 232. 3 units. *Knoerr*

**234S. Problems in the Philosophy of Biology.** Prerequisite: consent of instructor. See C-L: Philosophy 234S; also C-L: Zoology 234S. 3 units. *Brandon (philosophy)*

**237L. Systematic Biology.** Theory and practice of identification, species discovery, phylogeny reconstruction, classification, and nomenclature. Prerequisites: introductory biology and one course in animal or plant diversity. C-L: Zoology 237L. 3 units. *Lundberg (zoology) and Mishler*

**240L. Plant Diversity.** Major groups of the living plants; their evolutionary origins and phylogenetic relationships. Prerequisite: introductory biology. 3 units. *Mishler, Searles, or Wilbur*

**242L. Systematics.** Principles of vascular plant taxonomy, with practice in identification of the local flora. Lectures, laboratories, and field trips. Prerequisite: one year of biology. 3 units. *Wilbur*

**252L. Plant Physiology.** The principal physiological processes of plants including respiration, photosynthesis, water relations, and factors associated with plant morphogenesis. Prerequisites: introductory college biology and one year of chemistry; organic chemistry is desirable. 3 units. *Siedow*

**253. Biophysical Plant Physiology.** Application of physical principles to such processes as ion transport, water relations, and the interconversion of energy in plant cells. Prerequisites: Biology 152L and Mathematics 32 or equivalent. 3 units. *Knoerr or Siedow*

**255L. Molecular Systematics and Evolution.** Descriptive and experimental procedures used to assess evolutionary diversity for analysis of population genetics and systematic relationships. Laboratory problems, discussion, and individual research projects. Prerequisites: basic course work in systematics, evolution, and genetics. 3 units. *Vilgalys*

**256L,S. Plant Biosystematics.** Descriptive and experimental procedures used to assess systematic implications of plant evolution. Laboratory, discussion, and field-oriented problems. Prerequisites: basic courses in systematics and genetics. 3 units. *Vilgalys*

**261. Photosynthesis.** Principles of plant photosynthesis: developmental, mechanistic, regulatory, and ecological aspects of the photosynthetic process. Prerequisite: Biology 152L or Botany 252L. 3 units. *Siedow*

**263L. Tropical Seaweeds.** Collection, preservation, description, illustration, and descriptive ecology. Two-week field study. Prerequisite: Biology 140L or equivalent or consent of instructor. C-L: Marine Sciences 263L. 2 units. *Searles*

**265L. Physiological Plant Ecology.** The physiological approach to interpreting adaptation in plants, with emphasis on terrestrial seed plants. Prerequisites: Biology 110L and 152L or equivalent. 3 units. *Strain*

**266. Plant Population Biology.** Theoretical, experimental, and field approaches to plant population dynamics; population growth and regulation; effects of density, competition, and predation. 3 units. *Staff*

**267L. Community Ecology.** Mechanisms that determine the distribution and abundance of plants and animals: geology, climate, physiography, soils, competition, and history. Lectures focus on ecological principles. Seminars and weekend field trips. Prerequisites: an introductory ecology course and consent of instructor. C-L: Zoology 267L. 3 units. *Christensen and H. Wilbur (zoology)*

**269. Advanced Cell Biology.** Prerequisite: introductory cell biology or consent of instructor. See C-L: Zoology 269; also C-L: Cell Biology 269, Microbiology and Immunology 269 and The University Program in Cell and Molecular Biology. 3 units. *McClay (zoology) and staff*

**272. Biogeochemistry.** Processes controlling the circulation of carbon and biochemical elements in natural ecosystems and at the global level, with emphasis on soil and surficial processes. Prerequisite: Chemistry 12 or equivalent. C-L: Geology 272. 3 units. *Schlesinger*

**280. Principles of Genetics.** Structure and properties of genes and chromosomes in individual organisms and in populations. Prerequisite: introductory biology. C-L: Zoology 280 and The University Program in Genetics 280. 3 units. *Antonovics, Boynton, Gillham (zoology), and Laurie (zoology)*

**283. Extrachromosomal Inheritance.** Genetics, biochemistry, and molecular biology of the organelles of eukaryotic cells, and cellular symbionts. Prerequisite: introductory genetics. C-L: The University Program in Genetics and Zoology 283. 3 units. *Boynton and Gillham (zoology)*

**285S. Ecological Genetics.** Interaction of genetics and ecology and its importance in explaining the evolution, diversity, and distribution of plants and animals. Prerequisites: Biology 180 and Botany 286 or equivalents. 3 units. *Antonovics*

**286. Evolutionary Mechanisms.** Population ecology and population genetics of plants and animals. Fitness concepts, life history evolution, mating systems, genetic divergence, and causes and maintenance of genetic diversity. Prerequisites: Biology 140L and Botany 240L or Biology 74L, and a course in genetics. C-L: The University Program in Genetics and Zoology 286. 3 units. *Antonovics, Uyenoyma (zoology), and H. Wilbur (zoology)*

**287S. Macroevolution.** Evolutionary patterns and processes at and above the species level. Topics include: species concepts, speciation, diversification, extinction, ontogeny and phylogeny, rates of evolution, and alternative explanations for adaptation and evolutionary trends. Prerequisite: one course in plant or animal diversity. C-L: Zoology 287S. 3 units. *Mishler and Roth (zoology)*

**293L. Population Biology.** Theoretical approach to population genetics, life table mathematics, life cycle evolution in plants and animals, population dynamics, and regulation. Laboratories emphasize experimental methods. Individual projects and weekend field trips. Prerequisites: calculus, ecology, and consent of instructor. C-L: Zoology 293L. 3 units. *Antonovics and H. Wilbur (zoology)*

**295S, 296S. Seminar.** Credit to be arranged. *Staff*

**300. Tropical Biology: An Ecological Approach.** Highly intensive, field-oriented course conducted in Costa Rica under auspices of the Organization for Tropical Studies. For additional information refer to the chapter "Special and Cooperative Programs." 6 to 8 units. *Staff*

**305S, 306S. Plant Systematics Seminar.** Weekly presentation of current research in plant systematics by students, faculty, and invited speakers. 1 unit. *Vilgalys*

**310S, 311S. Plant Ecology Seminar.** Discussion of current research and literature. 1 unit. *Staff*

**315S, 316S. Population Genetics Seminar.** Discussion of recent developments in population genetics. Topics include population dynamics, forces affecting gene frequency change, molecular evolution, philosophy of evolutionary biology. Student presentations are integral to the course. 1 unit. *Antonovics*

**320S, 321S. Systematics Discussion Group.** An informal discussion group. Topics vary from semester to semester; cover systematic and evolutionary biology in the broad sense. 1 unit. *Staff*

**325S, 326S. Developmental, Cellular, and Molecular Biology Seminar.** Weekly presentations in developmental, cellular, and molecular biology topics by students, faculty, and invited speakers. 1 unit. *Staff*

**330L. Environmental Monitoring and Instrumentation.** Methods of measuring and monitoring the earth's physical environment with emphasis on water and air resources. Characteristics and uses of contemporary sensors, measurement and data acquisition systems. Methods of obtaining and processing computer compatible data records. Prerequisite: consent of instructor. C-L: Forestry and Environmental Studies 330L. Spring, on demand. 4 units. *Knoerr*

**359, 360. Research in Botany.** Individual investigation in the various fields of botany. C-L: Marine Sciences 359, 360. Credit to be arranged. *All members of the graduate staff*

## COURSES CURRENTLY UNSCHEDULED

209L. Lichenology

243S. Classification of Angiosperms

247L. Plant Ecology

270L. Plant Anatomy

344. Micrometeorology and Biometeorology Seminar



## RELATED PROGRAMS

**The University Program in Cell and Molecular Biology.** Cell and molecular biology courses offered by the botany department are an integral part of this interdepartmental program. Refer to the announcement in this bulletin under Cell and Molecular Biology for descriptions of the following courses: 259. Molecular Biology I: Protein and Membrane Structure/Function, and 264. Cell and Molecular Biology Seminar.

**The University Program in Genetics.** Genetics courses offered by the botany department are an integral part of this interdepartmental program. Refer to the announcement in this bulletin under the University Program in Genetics for more information.

**The University Program in Marine Sciences.** Interdisciplinary programs emphasizing marine botany are available. Refer to the section on the University Program in Marine Sciences.

**Program in Tropical Biology.** Fellowships are available for travel and subsistence in field-oriented programs in Central America. Refer to the section on Organization for Tropical Studies in the chapter "Special and Cooperative Programs."

## Business Administration

Professor Keller, *Dean* (219W Fuqua School of Business); Professor Bettman, *Director of Graduate Studies* (429E Fuqua School of Business); Professors R. Ashton, Baligh, Burton, Cohen, Forsyth, Laughunn, Lewin, Magat, Payne, Sarin, Staelin, and Winkler; Associate Professors A. Ashton, Breeden, Edell, Gardner, Huber, Mazzola, McCann, Moore, Ricks, Sheppard, Whaley, and Zeithaml; Assistant Professors Boulding, Butt, Daniels, Feinberg, Foster, Francis, Gresov, Harvey, Hemler, Kirmani, Kishimoto, Lindahl, McCadle, Moore, Nau, Philbrick, Purohit, Romanelli, Stephan, and Viswanathan

The Ph.D. in Business Administration program prepares candidates for research and teaching careers at leading educational institutions and for careers in business and governmental organizations where advanced research and analytical capabilities are required. The Ph.D. program places major emphasis on independent inquiry, on the development of competence in research methodology, and on the communication of research results.

The student and his/her faculty committee determine the specific program of study. Each student takes a comprehensive examination at the end of the second year or at the beginning of the third year of residence. The final requirement is the presentation of a dissertation. The Ph.D. program usually requires four years of work beyond the bachelor degree.

Refer to the *Bulletin of Duke University: The Fuqua School of Business* for a complete list of courses and course descriptions.

**510. Bayesian Inference and Decision.** Methods of Bayesian inference and statistical decision theory, with emphasis on the general approach of modeling inferential and decision-making problems as well as the development of specific procedures for certain classes of problems. Topics include subjective probability, Bayesian inference and prediction, natural-conjugate families of distributions, Bayesian analysis for various processes, Bayesian estimation and hypothesis testing, comparisons with classical methods, decision-making criteria, utility theory, value of information, and sequential decision making. 3 units. *Winkler*

**513. Choice Theory.** This seminar deals with the topics of measurement theory, conjoint measurement, expected utility and subjective expected utility theory, multiattribute utility theory and recent advances in preference modeling (generalized nonlinear utility theories). The goal of this seminar is to equip students with tools so that they can use preference modeling in a wide variety of social science applications. 3 units. *Sarin*

**521. Organization Seminar: A Micro Focus.** Individual and small group behavior in organizations. Theories of motivation, decision making, interpersonal behavior, group processes, and leadership. A variety of research approaches and methods includes presentation of behavioral research by members of the Fuqua School of Business and other researchers. 3 units. *Staff*

**522. Organization Seminar: A Macro Focus.** The organization and the subunits which make up the organization. Theories of organization, structure, decentralization, divisionalization, functional area integration, task design, incentives and rewards, information systems, and decision rules are developed with an orientation toward their choice and design for high performance. Includes presentation of research by members of the Fuqua School of Business and other researchers. 3 units. *Staff*

**525. Behavioral Decision Theory.** How people process information when making judgments and choices, and with how knowledge of the psychology of decisions can be used to improve decision processes. Five basic topics of research will be covered: (1) thinking about uncertainty, (2) multiattribute preferences, (3) risk taking, (4) problem structuring, and (5) group decision making. Examples of behavioral research will be drawn from the areas of accounting, finance, marketing, medicine, organizational theory, and public policy, as well as the more basic behavioral sciences. 3 units. *Payne*

**531. Financial Accounting Seminar.** The nature of published financial statement information and its relationship with various economic variables. The list of related variables might include stock market data, bankruptcy filings, and the actions of various users of financial statement information, including management, investors, creditors, and regulators. The focus is on the current research methodologies and research efforts used to analyze the above relationships. A background in masters-level accounting and finance is assumed. 3 units. *Staff*

**532. Management Accounting Seminar.** Information systems and their use in facilitating management decision making and organizational control. Emphasis on the appropriate research methodologies and paradigms including information economics, decision theory, and organizational theory. Topics include budgeting, incentive systems/performance evaluation, variance investigation, and cost allocation. 3 units. *Staff*

**551. Corporate Finance Seminar.** Introduction to research areas in corporate finance. Emphasis on the research interests of the instructor, and one of the following topics to be explored in depth: capital budgeting, capital structure, mergers and acquisitions, international finance, and cash management. 3 units. *Staff*

**552. Investment Seminar.** Survey of research in the investment area and exploration in depth of one or more problems in which research is currently active. Emphasis determined by the instructor from one or more of the following areas: valuation of risky securities, capital asset pricing model and extensions, capital market efficiency, portfolio theory, options and warrants, investment management, and futures contracts. 3 units. *Staff*

**553. Portfolio Theory and Asset Pricing.** This course mathematically derives well-known results in portfolio theory and asset-pricing models in finance. Topics to be covered include: single-period mean-variance efficient portfolios and the CAPM; pareto optimal allocations; multiperiod and continuous-time optimal consumption and portfolio rules; intertemporal asset-pricing model; arbitrage pricing theory; the term structure of interest rates and inflation risk; allocational roles of futures and options; and pricing and hedging results. Basic mathematics background in calculus, statistics, matrix algebra, optimization and dynamic programming is required. MBA-level courses in options, futures, and investments are prerequisites. 3 units. *Breeden*

**561. Seminar in Quantitative Research in Marketing.** An overview of the quantitative techniques which are important in marketing research. Each model and technique

will be examined in considerable detail so as to permit an understanding of its assumptions, structure, and usefulness. Topics covered will include the general data analysis techniques as well as models from advertising, new products, and pricing decisions. 3 units. *Staff*

**562. Seminar in Behavioral Models in Marketing.** Examines the development of research in consumer behavior. Major emphasis is given to theoretical developments and empirical research. Students are expected to formulate and test a framework or model of consumer behavior with respect to a marketing problem or topic. 3 units. *Staff*

**563. Marketing Models Seminar.** The primary goals of this seminar are (a) to critically review the most current research in marketing and (b) to gain a better understanding of and ability to build one's own model. After taking this course, students should be able to understand the assumptions and mathematical development of the current quantitative work in marketing and to use this understanding to develop meaningful extensions. 3 units. *Staelin*

**571. Operations Strategy Seminar.** Recent developments in the strategy of operations in both the manufacturing and service sectors. Topics include the focused factory concept, Japanese manufacturing philosophy, technological policy toward new process development and toward new product introduction, vertical integration, choice of capacity and location, industry analysis, and the impact of government regulation. Emphasis on the development of hypotheses about strategic topics and the empirical means by which they can be tested. 3 units. *Staff*

**572. Seminar in Operational and Technological Tactics.** Current issues in the day-to-day management of manufacturing and service delivery systems. Topics include material requirements planning, capacity requirements planning, quality of work life projects, productivity measurement and enhancement, implementation of new product introductions and production process modifications, quality assurance, production planning and scheduling, and logistics. Concentration on the substance of recent developments, the generation and test of hypotheses about tactical issues, and the applicability of various optimization techniques to the advance of operation tactics. 3 units. *Staff*

**591. Selected Topics in Business.** Allows the doctoral student the opportunity to study special topics in management on an occasional basis depending on the availability and interests of students and faculty. 3 units. *Staff*

**597. Dissertation Research.** For students actively pursuing research on their dissertation. Prerequisites: student must have passed the preliminary examination and have the consent of the Director of the Doctoral Program and instructor. Credit to be arranged. *Staff*

**598. Independent Study.** Allows the doctoral student the opportunity to engage in study or tutorial on special topics on an individual basis under the supervision of a faculty member. Prerequisites: Doctoral Program standing and consent of the Director of the Doctoral Program and instructor. Credit to be arranged. *Staff*

**599. Directed Research.** Allows the doctoral student to engage in individual research projects under the supervision of a faculty member. Prerequisites: Doctoral Program standing and consent of the Director of the Doctoral Program and instructor. Credit to be arranged. *Staff*

## The University Program in Cell and Molecular Biology

*Program Administration:* Professor Hill, *Director* (biochemistry); Associate Professor B. Kaufman, *Associate Director* (biochemistry); Professors McClay (zoology), Mills (pharmacology), Pizzo (pathology), Siedow (botany), Siegel (biochemistry), and Simon (neurobio-



logy); Associate Professors Caron (cell biology) and Keene (microbiology and immunology)

*Faculty:* A complete list of faculty, including research interests, will be made available to prospective students.

Research training in cell, developmental, and molecular biology is found in eight departments at Duke University: biochemistry, botany, cell biology, microbiology and immunology, neurobiology, pathology, pharmacology, and zoology. To effectively utilize this broad spectrum of expertise for the training of promising young scientists while still providing a coherent curriculum, the Duke University Program in Cell and Molecular Biology has been established.

During the first year of doctoral study a student will complete the program's three-course sequence presenting current understanding and research activities in cell biology and the molecular biology of nucleic acids, proteins, and membranes. Each student will also affiliate with a department, fulfill departmental requirements, and choose elective courses in an area of specialization. Research training is stressed throughout the program and dissertation research usually begins by the third semester. Normally the dissertation adviser will be chosen from within the student's own department but, depending on the student's research interests, dissertation research with an adviser in another department may be approved.

Prospective students may apply directly to the Cell and Molecular Biology Program or to one of the eight participating departments. Those who apply to the program must also designate a departmental preference. Applicants must have demonstrated, in addition to overall academic excellence, a proficiency in the biological and physical sciences. Applications for admission and fellowship support must be received by February 1, but early applications may receive advanced consideration.

**259. Molecular Biology I: Protein and Membrane Structure/Function.** Detailed concepts of the structure and function of proteins as enzymes and as structural elements of cellular substructures, including: protein primary structure and its determination, patterns of protein folding, mechanisms of enzyme catalysis and regulation, function and formation of multimeric protein assemblies, proteins and other constituents of biological membranes. Prerequisite: introductory biochemistry or consent of instructor. C-L: Biochemistry 259, Cell Biology 259, and Microbiology and Immunology 259. 3 units. *Erickson and staff*

**264. Cell and Molecular Biology Seminar.** Required of all students. Third- and fourth-year students discuss their dissertation research. 1 unit. *Staff*

**268. Molecular Biology II: Nucleic Acids.** Structure and metabolism of nucleic acids in the context of their biological function in information transfer. Prerequisites: introductory biochemistry, Biochemistry 259, or consent of instructor. C-L: Biochemistry 268, Cell Biology 268, Microbiology and Immunology 268, and The University Program in Genetics. 4 units. *Modrich and staff*

**269. Advanced Cell Biology.** Structural and functional organization of cells and their components with emphasis on current research problems and prospects. Prerequisite: introductory cell biology or consent of designated instructor. C-L: Botany 269, Cell Biology 269, Microbiology and Immunology 269, and Zoology 269. 3 units. *McClay and staff*

## Cell Biology

Professor Erickson, *Interim Chairman*; Professor Lieberman, *Director of Graduate Studies*; Professors Blum, Camporesi, Counce, Gutknecht, Handwerger, Hatchell, Jöbssis, Johnson, Mandel, Moses, Nicklas, Padilla, Plonsey, Reedy, Robertson, Somjen, Sommer, and Spach; Associate Professors N. Anderson, C. Bonaventura, J. Bonaventura, Caron, Corless, Effmann, Greenfield, Kootsey, McIntosh, McManus, Mills, Schachat, Schomberg,

and Vigna; Assistant Professors P. Anderson, Argon, Dennis, Garrett, Jakoi, Lamvik, LeFurgey, Saling, Wallace, Williams, and Yarger; Associate Medical Research Professors Aitken, Taylor, and Sylvia; Assistant Medical Research Professors Gerth and Lobaugh; Adjunct Assistant Professors Beall, Carter and Kopf

The Department of Cell Biology offers graduate training in modern cell biology and physiology leading to the Ph.D. degree.

Department research interests center on cell structure and function at several levels of biological organization. Areas of research include: membrane function and structure; cell motility and cytoskeletal elements; macromolecular self-assembly and structure; chromosome biology; molecular mechanisms of signal transduction; genetics and molecular biology of contractile proteins; ultrastructure of cardiac and striated muscle; biophysics of artificial membranes; and molecular and structural biology of vertebrate photoreceptors. Other interests include genetics and development; cell growth and differentiation; and cellular physiology.

Within the Division of Physiology, research focuses on: membrane transport and electrophysiology; metabolism; cellular physiology; microcirculation; hyperbaric physiology; and theoretical studies and modeling of physiological processes.

The department has excellent facilities for light and electron microscopy; image processing, analysis and 3-D reconstruction; X-ray diffraction; and computer modeling and simulation. The cell biology department also participates in several university-wide interdisciplinary training programs, such as those in genetics, cell and molecular biology, neurobiology, pharmacology, biomedical engineering and toxicology.

For further information, contact the departmental Director of Graduate Studies.

**200. Medical Physiology.** Lectures and conferences on cell and organ physiology. Human and medical aspects are stressed in clinical conferences. Lectures, conferences, and computer-based laboratory exercises. Consent of instructor required. Students may take either 200 or 203-204, but not both, for credit. Fall. 5 units. *Somjen and staff*

**203. Introduction to Modern Physiology I.** The course sequence 203-204 is intended to provide an in-depth introduction to modern integrative physiology. Topics to be covered include: ionic distribution and cellular electric potentials; osmotic and ionic regulation; kidney function; hydrodynamics of fluid flow in blood vessels; autoregulation of flow; pulmonary function and its regulation; regulation of contraction in different kinds of muscle. Cell Biology 203 and 204 are required of all graduate students in the Division of Physiology. Nonmajors may take either 203 or 204 upon consent of course director. Fall. 3 units. *Blum and staff*

**204. Introduction to Modern Physiology II.** Topics to be covered include: cardiac function and its regulation; the gastrointestinal system, including regulation of food and water intake, of motility, and of digestion; hormonal control of growth, reproduction, lactation and metabolism; thermoregulation and role of brown adipose tissue in a variety of physiological states; dynamics of bone and cartilage and control of systemic calcium levels. (Continuation of 203.) Spring. 3 units. *Blum and staff*

**205. Design and Analysis of Biological Experiments.** An introductory-level course for individuals engaged in or planning research projects in life sciences. Emphasis is on development of an adequate background in the fundamentals of probability, statistics, and hypothesis testing for application of these principles to commonly encountered research situations. The course will include lectures, hands-on use of the Statistical Analysis System (SAS) computer package for data analysis and critical evaluation of experimental designs employed in representative studies from the literature. Fall. 2 units. *Lobaugh*

**210. Individual Study.** Directed reading and research in cell biology/physiology. Descriptions of specific areas of study may be obtained from the Director of Graduate Studies. Prerequisite: consent of Director of Graduate Studies. C-L: Marine Sciences 210. 3 to 9 units each. *Staff*

**217. Membrane Transport.** Basic principles of the transport of water and solutes across biological and model membranes. The course uses physicochemical principles to provide a comprehensive understanding of phenomena such as active and passive transport, energy barriers through membranes, surface effects, and ion selectivity. The methodology and conceptual framework for the study of transport are described with selected examples from bilayers, red blood cells, nerve, and epithelia. Physical chemistry is recommended. Prerequisite: consent of instructor. Spring. 3 units. *Mandel*

**219. Molecular and Cellular Bases of Differentiation.** A multidisciplinary approach stressing the molecular, cellular, and genetic processes involved in differentiation in eukaryotes. C-L: Biochemistry 219, Microbiology and Immunology 219, and Pathology 219. 3 units. *Counce and staff*

**225. Neurobiology of Sensory Systems.** See C-L: Neurobiology 225. Spring. 3 units. *Simon, Corless, and guest lecturers*

**230. Cytoskeleton and Cell Motility.** Recent research articles will be read and discussed in depth at a two-hour meeting once a week. Instructors will select papers and provide a brief introduction. Students will present papers and lead discussion in a journal club format. Areas covered will include: microtubules, actin, intermediate filaments, spectrin, clathrin; dynamic instability; kinesin motility, amoeboid crawling. Spring 1990 and alternate years thereafter. 2 units. *Bennett, H. Erickson, and Schlossman*

**232. Extracellular Matrix and Cell Adhesion.** Recent research articles will be read and discussed in depth at a two-hour meeting once a week. Instructors will select papers and provide a brief introduction. Students will present papers and lead discussion in a journal club format. Topics covered will include: fibronectin, laminin, hexabrachion, collagens; integrins and cell-substrate adhesion; cell-cell adhesion molecules. Alternate years. 2 units. *Bennett, H. Erickson, and Lightner*

**233. Introduction to Biomedical Simulation.** An introduction to the methods and applications of computer simulation to a wide range of biomedical problems. Subjects to be discussed include: the goals and objectives of simulation, selection of numerical methods for solving model equations, parameter fitting and optimization, experiment planning using simulation, evaluation, and selection of models, as well as several sample applications. Prerequisites: calculus; prior computer or programming experience *not* required. Fall. 3 units. *Kootsey and staff*

**234. Methods in Physiological Simulation.** Application of digital computers to modeling physiological processes. Emphasis on practical uses and pitfalls in both continuous and discrete systems. Topics studied include: membrane excitability, epithelial transport, metabolic pathways, sensory transduction, molecular graphics, and cellular motility. Methods include: numerical solution of differential equations, graph theory, and finite element methods. Prerequisites: a course in physiology and knowledge of a high-level computer language, or consent of instructor. Spring. 3 units. *Magid and staff*

**236S. Seminar on the Cellular and Molecular Biology of Skeletal Muscle.** This seminar course will focus on the molecular and cellular biological approaches to skeletal muscle development and physiology. Topics will include the role of cell lineage, developmentally preprogrammed patterns of contractile protein expression, the nature of muscle fiber diversity and the genetic mechanisms that generate contractile protein heterogeneity. Spring. 3 units. *Schachet*

**259. Molecular Biology I: Protein and Membrane Structure/Function.** See C-L: Biochemistry 259; also C-L: Microbiology and Immunology 259, and the University Program in Cell and Molecular Biology. 3 units. *Erickson and staff*



**268. Molecular Biology II: Nucleic Acids.** See C-L: Biochemistry 268; also C-L: Microbiology and Immunology 268, The University Program in Cell and Molecular Biology, and The University Program in Genetics. 4 units. *Modrich and staff*

**269. Advanced Cell Biology.** See C-L: Zoology 269; also C-L: Botany 269, Microbiology and Immunology 269; and the University Program in Cell and Molecular Biology. 3 units. *McIntosh and staff*

**280. Student Seminar.** Preparation and presentation of seminars to students and faculty on topics of broad interest to cell biology and physiology. Required of all cell biology department students C-L: Neurobiology 280. 2 units. *Staff*

**307. Microscopic Anatomy.** Lectures on structural organization of different tissues and organs, as determined by light and electron microscopy with emphasis on the relation of structure to function at the cellular level. The laboratory provides practical experience with light microscopy, studying and analyzing our extensive slide collection of mammalian tissues. Prerequisite: consent of instructor. Fall. 3 units. *McIntosh and staff*

**312. Research.** Specific areas of investigation include: membrane structure; extracellular matrix; cell adhesion; cell motility; cytoskeletal elements; chromosome structure and movement; genetics and molecular biology of contractile proteins; muscle ultrastructure; gamete biology; molecular and structural biology of photoreceptors; hormone receptors; cell growth; developmental biology; membrane transport and electrophysiology; metabolism; cardiovascular physiology; microcirculation; hyperbaric physiology; and theoretical studies and computer modeling of physiological processes. Variable units. *Staff*

**313, 314. Departmental Seminar.** Regular meeting of graduate students and staff in which current research problems will be presented. 1 unit. *Staff*

**340. Tutorial in Advanced Cell Biology/Physiology.** Topics for intensive reading and discussion chosen according to the student's interests, related to basic problems in biophysics, cytology, endocrinological control, growth and development, neuroanatomy, physical differentiation, and evolutionary origins of functional microsystems. Prerequisite: consent of instructor. Variable units. *Staff*

**399. Readings in Cell Biology.** Directed reading and research in cell biology/physiology. Prerequisite: consent of Director of Graduate Studies. 3 to 9 units each. *Staff*

**417. Cellular Endocrinology.** Current concepts of the mechanisms of action of hormones at the cellular level, including hormone-receptor interactions; secondary messenger systems for hormones; mechanisms of regulation of hormone responsiveness; regulation of growth, differentiation, and proliferation; cellular and electrophysiological mechanisms of secretory stimulus sensing and transduction; systems approach to feedback regulation; and information transfer in an endocrine system. Lectures by local and outside clinical faculty will stress the clinical correlation of the basic concepts elaborated in the course. Students will be expected to participate in one seminar presentation. C-L: Pharmacology 417. Fall. 3 units. *Caron, staff, and guest faculties*

**418. Reproductive Biology.** An in-depth study of male and female reproductive processes including hypothalamic, pituitary, and gonadal control mechanisms, as well as the physiology of pregnancy and parturition. Lectures by guest clinical faculty will emphasize the interface between basic science and clinical medicine. The lecture material in each section of the course is followed by seminar presentations which will contribute to Cell Biology 424, a corequisite for the course. Spring. 2 units. *N. Anderson, Schomberg, and Tyrey*

**424. Seminar in Reproductive Biology.** Selected topics in reproductive biology will be chosen for in-depth reading and analysis in the seminar format. Can be taken independently or as a corequisite with Cell Biology 418. 1 unit. *N. Anderson, Schomberg, and Tyrey*

## COURSES CURRENTLY UNSCHEDULED

220. Developmental Biology

281. Teaching in Physiology

288S. The Cell in Development and Heredity

## Chemistry

Professor Arnett, *Chairman* (101 Gross Chemical Laboratory); Professor Baldwin, *Director of Graduate Studies* (373 Gross Chemical Laboratory); Professors Bonk, Chesnut, Crumbliss, Fraser-Reid, Krigbaum, Lochmüller, McPhail, Palmer, Porter, Smith, Strobel, Wells, and Wilder; Associate Professors Henkens, McGown, and Shaw; Assistant Professors MacPhail, Polniaszek, and Prisant; Professors Emeriti Bradsher, Hobbs, Poirier, and Quin; Adjunct Professors Chao, Ghirardelli, Jeffs, Millington, Morosoff, Painter, Pitt, Preston, Spielvogel, and Sternback

In the Department of Chemistry graduate work is offered leading to the M.S. and Ph.D. degrees. Before undertaking a graduate program in chemistry, a student should have taken an undergraduate major in chemistry, along with related work in mathematics and physics.

Graduate courses in the department are offered in the fields of analytical, inorganic, organic, and physical chemistry. Research programs are active in all these fields.

A booklet providing detailed information on the department is available from the Director of Graduate Studies.

### For Seniors and Graduates

**201. Molecular Spectroscopy.** Selected spectroscopic methods in the study of molecular structure. Symmetry and group theoretical basis for selection rules, theories of magnetic and optical resonance, and interpretation of spectra; examples from both inorganic and organic chemistry. Three lectures. Prerequisite: consent of department. 1 to 3 units. *Fraser-Reid, Palmer, and Smith*

**203. Quantum Chemistry.** Basic principles of quantum and group theoretical methods. Topics include symmetry, a review of the fundamentals, and the mathematical foundations of quantum theory. Emphasis on the application of molecular orbital theory to organic and inorganic systems. Prerequisite: Chemistry 162. 1 to 3 units. *Chesnut and Polniaszek*

**205. Structure and Reaction Dynamics.** Structure and mechanisms in organic and inorganic compounds, substitution reactions, linear free energy relations, and molecular rearrangements. Emphasis on the use of kinetic techniques to solve problems in reaction mechanisms. Three lectures. Prerequisite: consent of department. 1 to 3 units. *Arnett, Crumbliss, and Polniaszek*

**207. Principles of Kinetics, Thermodynamics, and Diffraction.** Three lectures. Prerequisite: consent of instructor. 1 to 3 units. *Smith, Prisant, and McPhail*

**275, 276. Advanced Studies.** (1) Analytical chemistry, (2) inorganic chemistry, (3) organic chemistry, and (4) physical chemistry. Open to especially well-prepared undergraduates by consent of department. 6 units. *McPhail, Smith, or staff*

### For Graduates

**300. Basic Statistical Mechanics.** Fundamentals of quantum and classical statistical mechanics using the ensemble approach. Emphasis on systems of weakly interacting particles with internal degrees of freedom. 3 units. *MacPhail or staff*

**302. Basic Quantum Mechanics.** The fundamentals of quantum mechanics with special emphasis on chemical applications. Topics included are: linear algebra, the uncertainty relations, angular momentum, perturbation theory and time dependent phenomena, molecules in electromagnetic fields, group methods, and electron correlation. 3 units. *Chesnut or staff*

**303, 304. Special Topics in Physical Chemistry.** Presentation of one or more topics of staff interest such as advanced methods in crystallography, light scattering and small angle X-ray diffraction, application of ESR spectroscopy to chemical problems, electronic spectroscopy of proteins, group theory, intermolecular forces, liquid crystals, methods of determining the rates of elementary steps in reaction kinetics, physical chemistry of aerosols, physical-chemical methods of polymer characterization, structure and bonding in metallo-enzymes, statistical mechanics of fluids, topics in structural chemistry, and triplet excitons. 1 to 3 units each. *Staff*

**310. Theoretical and Structural Inorganic Chemistry.** An advanced study of theoretical concepts and structural determination techniques as applied to inorganic systems. Areas included are crystal field and ligand field theories; magnetic susceptibility; and electronic, infrared, and Raman spectroscopy. 3 units. *Crumbliss and Palmer*

**312. Inorganic Reactions and Mechanisms.** Chemistry of main group and transition elements. Emphasis on current developments in synthetic and mechanistic studies of inorganic, organometallic, and organometalloid compounds. 3 units. *Crumbliss and Wells*

**313. Special Topics in Inorganic Chemistry.** Lectures, oral reports, and discussions on advanced topics and recent advances in the field of inorganic chemistry. Examples of topics which may be discussed are bioinorganic chemistry, fluxional molecules, homogeneous catalysis, synthesis and properties of selected groups of compounds, and new physical methods. 1 to 3 units. *Staff*

**320. Synthetic Organic Chemistry.** A study of the scope and limitations of the more important types of reactions in synthetic organic chemistry. Some discussion of the rapidly developing use of transition metals, complex hydrides, and photochemistry will be included. 3 units. *Baldwin, Fraser-Reid, or Polniaszek*

**322. Organic Reactive Intermediates.** A discussion of reactive intermediates in organic chemistry. Topics will include carbanions, carbenes, carbonium ions, free radicals, photochemical excited states, and other reactive species. 3 units. *Arnett and Porter*

**324. Special Topics in Organic Chemistry.** Advanced topics and recent developments in the field of organic chemistry. Representative topics include heterocyclic chemistry, natural products chemistry, carbohydrate chemistry, molecular mechanics, and two-dimensional NMR spectroscopy. Lectures and written and oral reports. 1 to 3 units. *Staff*

**330. Separation Science and Fundamental Electrochemistry.** Section .01, fundamental separation chemistry; section .02, practical aspects of chromatographic separation methods; section .03, fundamentals of electrochemistry. 1 to 3 units. *Lochmüller or Strobel*

**331, 332. Special Topics in Analytical Chemistry.** An advanced treatment of important areas in modern analysis. Possible topics include: electrochemistry, small computer applications, magnetic resonance, and problem-solving approaches. 1 to 3 units each. *Staff*

**334. Chemical Instrumentation and Practical Electrochemistry.** Section .01, basic chemical instrumentation; section .02, optical chemical instrumentation; section .03, practical electrochemistry. 1 to 3 units. *McGown or Strobel*

**373, 374. Seminar.** One unit is required of all Ph.D. candidates in chemistry. One hour a week discussion. 1 unit each. *All members of the graduate staff*



**375, 376. Research.** The aim of this course is to give instruction in methods used in the investigation of original problems. Individual work and conferences. 1 to 6 units each. *All members of the graduate staff*

**377. Research Orientation Seminar.** A survey of departmental research. Required of all entering graduate students in chemistry. Prerequisite: consent of Director of Graduate Studies. 1 unit. *All members of the graduate staff*

## Classical Studies

Professor Newton, *Chairman* (326 Carr); Associate Professor Rigsby, *Director of Graduate Studies* (327 Carr); Professors Oates and Richardson; Associate Professors Boatwright, Burian, Stanley, and Younger; Professor Emeritus Willis

The Department of Classical Studies offers graduate work leading to the A.M. and Ph.D. degrees in classical studies. Work in the department encompasses all aspects of the Greco-Roman world: students in the program are able, through course work, directed research, and their own teaching, to prepare for careers of teaching and research as broadly trained classical scholars. For regular admission, students should offer at least three years of college study in one of the classical languages and two in the other. Before developing a specialization within the program, students are expected to acquire facility in both Greek and Latin, a broad knowledge of the literatures and of ancient history and archaeology, and command of research methods. Reading knowledge of French and German is required for the Ph.D. The resources of the department include important collections of Greek and Latin manuscripts and papyri, computer facilities in the ancient languages, and a valuable study collection of Greek and Roman art. The department publishes the journal *Greek, Roman, and Byzantine Studies*. The Director of Graduate Studies will provide on request a brochure giving further information about the department's requirements, resources, and financial aid; prospective students should also consult the general requirements of the University set forth in the chapter on "Registration" in this bulletin.

### GREEK

#### For Seniors and Graduates

- 200. Readings in Greek Literature.** 3 units. *Staff*
- 201. Studies in Greek Literature I.** 3 units. *Staff*
- 202. Studies in Greek Literature II.** 3 units. *Staff*
- 203. Homer.** Problems of language and structure in the *Iliad*; present state of Homeric scholarship. 3 units. *Stanley*
- 205. Greek Lyric Poets.** Fragments of the early lyric poets; selected odes of Pindar and Bacchylides. 3 units. *Burian or Stanley*
- 207. The Dramatists.** Readings and studies of selected plays by the major playwrights Aeschylus, Sophocles, Euripides, and Aristophanes. 3 units. *Burian*
- 210. Hellenistic Literature.** Examples of Hellenistic literature with emphasis on the *Argonautica* of Apollonius of Rhodes, and attention to the shorter poems of Theocritus and Callimachus. One course. *Stanley*
- 211S. Plato.** Selected dialogues. C-L: Philosophy 211S. 3 units. *Ferejohn*
- 217S. Aristotle.** Selected topics. C-L: Philosophy 217S. 3 units. *Ferejohn*

**222. The Historians.** Reading and studies in the major Greek historians Herodotus, Thucydides, and Xenophon. 3 units. *Rigsby*

#### **For Graduates**

**301. Seminar in Greek Literature I.** Selected authors and topics. 3 units. *Burian or Stanley*

**302. Seminar in Greek Literature II.** Selected authors and topics. 3 units. *Burian or Stanley*

**313. Seminar in Greek Epigraphy.** 3 units. *Rigsby*

**399. Directed Reading and Research.** Credit to be arranged. *Staff*

#### **Courses Currently Unscheduled**

**221. Early Greek Prose**

**226. The Orators**

**321. Seminar in Literary Papyri**

#### **LATIN**

##### **For Seniors and Graduates**

**200. Readings in Latin Literature.** 3 units. *Staff*

**201. Studies in Latin Literature I.** 3 units. *Staff*

**202. Studies in Latin Literature II.** 3 units. *Staff*

**206. Cicero.** 3 units. *Richardson*

**207S. Vergil's *Aeneid*.** Intensive analysis of all of Vergil's *Aeneid*, focusing on text and historical context, complemented by research papers and reports. 3 units. *Newton*

**211S. Elegiac Poets.** Analysis of most of the *corpora* of Propertius, Tibullus, and Ovid, with close attention to the stylistics of the poems, their place in the traditions of Latin love elegy, and their relation to other phenomena of the Augustan period. 3 units. *Richardson*

**214S. The Historians.** Investigations of the Romans' conceptions and practices of writing history, based on detailed analysis of the works of Sallust, Livy, and Tacitus. Additional readings in the fragments of other Latin historians, and in comparative Greek historians. 3 units. *Boatwright*

##### **For Graduates**

**301. Seminar in Latin Literature I.** Selected authors and topics. 3 units. *Boatwright, Newton, or Richardson*

**302. Seminar in Latin Literature II.** Selected authors and topics. 3 units. *Boatwright, Newton, or Richardson*

**312. Seminar in Latin Paleography.** 3 units. *Newton*

**314. Seminar in Latin Epigraphy.** 3 units. *Rigsby*

**315. Seminar in Roman Law.** 3 units. *Oates*

**399. Directed Reading and Research.** Credit to be arranged. *Staff*

### Courses Currently Unscheduled

- 204. Epic of the Silver Age: Lucan to Statius
- 205. The Roman Novel
- 208. Lyric and Occasional Poetry
- 221. Medieval Latin

### CLASSICAL STUDIES (ANCIENT HISTORY)

#### For Seniors and Graduates

222. **Fifth and Fourth Century Greece.** From the Persian Wars to the dominance of Philip of Macedon. C-L: History 260. 3 units. *Oates or Rigsby*

223. **Alexander and the Hellenistic World.** The achievements and legacy of Alexander the Great and the rise of Roman power in the Eastern Mediterranean. C-L: History 261. 3 units. *Oates*

224. **The Roman Republic.** The rise of Rome, to its mastery of the Mediterranean; the political, social, and intellectual consequences. C-L: History 263. 3 units. *Boatwright or Rigsby*

225. **The Roman Empire.** The foundation, consolidation, and transformation of Roman rule from Augustus to Diocletian. C-L: History 264. 3 units. *Boatwright*

258. **The Hellenistic and Roman East.** The social and cultural history of the Greco-Roman world, concentrating on papyrological evidence. Prerequisite: knowledge of ancient Greek and Latin. 3 units. *Oates*

#### For Graduates

- 321. **Seminar in Ancient History I.** Selected topics. 3 units. *Boatwright, Oates, or Rigsby*
- 322. **Seminar in Ancient History II.** Selected topics. 3 units. *Boatwright, Oates, or Rigsby*
- 399. **Directed Reading and Research.** Credit to be arranged. *Staff*

### Courses Currently Unscheduled

- 221. Archaic Greece
- 226. Late Antiquity
- 327. Seminar in Byzantine History

### CLASSICAL STUDIES (ARCHAEOLOGY)

#### For Seniors and Graduates

220S. **Studies in Greek Art.** Prerequisite: consent of instructor. See C-L: Art 220S. 3 units. *Castriota*

227S. **Studies in Roman Art.** Prerequisite: consent of instructor. See C-L: Art 221S. 3 units. *Castriota*

230S. **Medieval and Byzantine Art and Architecture.** Prerequisite: consent of instructor. See C-L: Art 230S; also C-L: Medieval and Renaissance Studies. 3 units. *Bruzelius or Wharton*

231S. **Greek Sculpture.** Free standing, relief, and architectural sculpture from the archaic period to the Hellenistic Age, representing changing aesthetic, social, and political aims. C-L: Art 222S. 3 units. *Stanley*



**232S. Greek Painting.** From the late Bronze Age to the fourth century B.C., with emphasis on archaic and classical Athenian vase painters. C-L: Art 223S. 3 units. *Stanley*

**233S. Greek Architecture.** Development of form and function in the various religious, civic, and domestic building types, from the Bronze Age through the Hellenistic period. C-L: Art 224S. 3 units. *Richardson*

**235S. Roman Architecture.** Development of design and engineering in the architecture of ancient Rome. The major building forms, public and private, and the principal styles from the regal period to Hadrian. C-L: Art 225S. 3 units. *Richardson*

**236S. Roman Painting.** Roman pictorial art with concentration on the wall paintings from Campania. Investigation of techniques, iconography, and the use of pictures in decoration. C-L: Art 226S. 3 units. *Richardson*

#### For Graduates

**311. Archaeology Seminar I.** Selected topics. 3 units. *Staff*

**312. Archaeology Seminar II.** Selected topics. 3 units. *Staff*

**399. Directed Reading and Research.** Credit to be arranged. *Staff*

#### Courses Currently Unscheduled

##### **234S. Roman Sculpture**

Under the terms of a cooperative agreement, graduate students of Duke University may take any graduate course offered by the Department of Classics of the University of North Carolina. A list of these courses will be sent upon request.

## Computer Science

Professor Rose, *Chairman* (206 North Building); Associate Professor Kedem, *Director of Graduate Studies* (202 North Building); Professors Biermann, Gallie, Loveland, Marinos, Patrick, Reif, Starmer, Trivedi, and Utku; Associate Professors Dugan, C. Ellis, Green-side, and Wagner; Assistant Professors Board, Gardner, Holliday, Nadathur, and Szyld; Research Associate Professors J. Ellis, Kootsey, and Ramm; Adjunct Associate Professor W. Coughran; Visiting Assistant Professor Gazit

The Department of Computer Science offers programs leading to the M.S. and Ph.D. degrees. The department also actively cooperates with the Computer Science Department of the University of North Carolina at Chapel Hill.

A student entering graduate work in computer science should have had three semesters of calculus and one semester of linear algebra, and have a knowledge of data structures, and of assembler as well as higher-level computer programming languages. Research interests of present faculty include mathematical foundations of computer science, artificial intelligence, analysis of algorithms, programming methodology, real-time computing, operating data base systems, computer systems design and analysis, parallel processing systems, scientific computation (including numerical analysis), and very large-scale integration.

Each student should consult the document *Graduate Degree Requirements of the Computer Science Department* for degree requirements not listed in this bulletin.

#### For Seniors and Graduates

**200. Programming Methodology I.** Practical and theoretical topics including structured programming, specification and documentation of programs, debugging and testing strategies, choice and effective use of programming languages and systems, psychology

of computer programming, proof of correctness of programs, analysis of algorithms, and properties of program schemata. Prerequisite: Computer Science 102. 3 units. *Wagner*

**201. Programming Languages.** Information binding, data structures and storage, control structures, recursion, execution environments, input/output; syntax and semantics of languages; study of PL/1, Fortran, Algol, APL, LISP, SNOBOL, and SIMULA; exercises in programming. Prerequisite: Computer Science 200. 3 units. *Holliday, or taught at UNC-CH as Comp 244*

**202. Applied Discrete Structures.** Aspects of discrete mathematics that are essential to the development of computer science. Topics from combinatorics and graph theory, discrete probability theory, and mathematical logic. Prerequisites: Mathematics 103 and 104 or equivalents. 3 units. *Staff*

**204. Computer Network Architecture.** Prerequisite: Electrical Engineering 157. See C-L: Electrical Engineering 204. 3 units. *Strole*

**207. Fault-Tolerant Computer Systems.** See C-L: Electrical Engineering 207. 3 units. *Board or Marinos*

**208. Digital Computer Architecture and Design.** See C-L: Electrical Engineering 208. 3 units. *Dollas or Marinos*

**209. Microprocessor Fundamentals and Applications.** See C-L: Electrical Engineering 209. 4 units. *George*

**210. Introduction to VLSI Design.** A first course in VLSI design with CMOS technologies. A study of devices, circuits, fabrication technology, logic design techniques, subsystem design and system architecture. Modeling of circuits and subsystems. Testing of gates, subsystems and chips, and design for testability. The fundamentals of full-custom design, and some semi-custom design. Prerequisites: logic design (Computer Science/Electrical Engineering 157 or equivalent), and Electronics (Electrical Engineering 161, or Computer Science/Electrical Engineering 160, or equivalent). C-L: Electrical Engineering 210. 3 units. *Dollas or Kadem*

**212. Introduction to Scientific Computing.** Practical introduction for graduate students and faculty to computer resources that facilitate scientific research: scientific word processing (Tex and LaTeX), symbolic manipulation programs, software tools, numerical software packages, and graphics. Case studies used to illustrate these resources. For noncomputer scientists. Prerequisites: Mathematics 103, 104 or equivalent; some programming experience. 3 units. *Gardner or Greenside*

**213. Introduction to Nonlinear Dynamics.** Introduction to the mathematical theory of nonlinear dynamics, and how this theory compares with physical experiments, with applications to biology (Turing states and morphogenesis), computer science (randomness and computability), mathematics (chaos and strange attractors), and physics (pattern formation and transition to turbulence). Prerequisites: Computer Science 51, Mathematics 111, and Physics 51, 52. C-L: Physics 213. 3 units. *Greenside*

**215. Artificial Intelligence.** Heuristic versus algorithmic methods; programming of games such as chess; theorem proving and its relation to correctness of programs; readings in simulation of cognitive processes, problem solving, semantic memory, analogy, adaptive learning. Prerequisite: Computer Science 102 or consent of instructor. 3 units. *Biermann, Loveland, or Nadathur*

**221. Numerical Analysis.** Error analysis, interpolation and spline approximation, numerical differentiation and integration, solutions of linear systems, nonlinear equations, and ordinary differential equations. Prerequisites: knowledge of an algorithmic program-

ming language, intermediate calculus including some differential equations, and Mathematics 104. C-L: Mathematics 221. 3 units. *Gardner, Greenside, or Szyld*

**222. Numerical Differential Equations.** Numerical methods for solving ordinary and partial differential equations, emphasizing nonlinear differential equations. Methods for solving ordinary differential equations that generalize to solve partial differential equations: finite difference, spectral, and finite element methods. Solution of hyperbolic, parabolic, and elliptic partial differential equations arising in scientific problems. Prerequisite: Computer Science 221. C-L: Mathematics 222. 3 units. *Gardner, Greenside, Rose, or Szyld*

**223. Numerical Linear Algebra.** Solution of large, sparse linear systems of equations. Storage schemes, graph theory for sparse matrices, different orderings to minimize fill, block factorizations, iterative methods, analysis of different splittings, conjugate gradient methods. Eigenvalue problems, QR factorization, Lanczos method, power method and inverse iteration, Rayleigh quotient. Prerequisite: Computer Science 221 or equivalent. C-L: Mathematics 223. 3 units. *Gardner, Greenside, Rose, or Szyld*

**224. Analysis of Algorithms.** Design and analysis of efficient algorithms. Design techniques include recursion, divide-and-conquer, and dynamic programming. Applications include sorting, searching, dynamic structures, path-finding, fast multiplication, fast Fourier transform. Nondeterministic algorithms. Computationally hard problems. NP-completeness. Prerequisites: Computer Science 102 and four semesters of college mathematics. 3 units. *Loveland or Reif*

**225. Formal Languages and Theory of Computation.** An introduction to the study of abstract machines and the languages they define, their capabilities and limitations. Finite-state automata, regular languages, pushdown automata, context-free languages, Turing machines, recursive functions and recursively enumerable sets, noncomputable sets, measures of complexity for algorithms. Prerequisites: four semesters of undergraduate mathematics. 3 units. *Loveland or Reif*

**226. Mathematical Methods for Systems Analysis I.** Basic concepts and techniques used in the stochastic modeling of systems. Elements of probability, statistics, queuing theory, and simulation. Prerequisites: four semesters of college mathematics. 3 units. *Trivedi*

**227. Mathematical Methods for Systems Analysis II.** Basic concepts and techniques used in the deterministic modeling of systems. Elements of linear algebra; linear, integer, dynamic, and geometric programming; and unconstrained and constrained optimization. Prerequisites: four semesters of college mathematics. 3 units. *Staff*

**231. Operating Systems.** Fundamental principles of operating system design applied to state-of-the-art computing environments (multiprocessors and distributed systems) including process management (coscheduling and load balancing), shared memory management (data migration and consistency), and distributed file systems. Advanced topics include transaction-based operating systems, reliable communication protocols, concurrency control and recovery mechanisms, computer security, and performance analysis. Prerequisite: Computer Science 104. 3 units. *Dugan, C. Ellis, Holliday, or Trivedi*

**232. Compiler Construction.** Models and techniques used in the design and implementation of assemblers, interpreters, and compilers. Lexical analysis, compilation of arithmetic expressions and simple statements, specifications of syntax, algorithms for syntactic analysis, code generation, and optimization techniques. 3 units. *Wagner*

**241. Data Base Methodology.** Basic concepts and principles. Relational, hierarchical, and network approaches to data organization; data entry and query language support for data base systems; theories of data organization; security and privacy issues.



Prerequisites: Computer Science 104 and 155. C-L: Mechanical Engineering and Materials Science 242. 3 units. *C. Ellis*

**245. Functional Analysis for Scientific Computing.** Linear spaces, topologies, norms, and completeness. Focus on Banach and Hilbert spaces including Sobolev spaces. Linear and nonlinear operators. Fréchet derivatives. Iterative methods for nonlinear operator systems, such as Newton-like methods. Applications. Intended for science and engineering students but not mathematics graduate students. Prerequisite: Computer Science 221. C-L: Mathematics 245. 3 units. *Rose or Szyld*

**252. Computer Systems Organization.** Hardware and software aspects. Processor, memory, device, and communication subsystems; case studies of hardware system organization, e.g., parallel, associative, fault-tolerant; organization of software systems to exploit hardware systems organization; economic and reliability aspects of various hardware organizations. Prerequisites: Computer Science 104 and 157. C-L: Electrical Engineering 252. 3 units. *J. Ellis or Patrick*

**265. Advanced Topics in Computer Science.** 3 units. *Staff*

**276. Communication, Computation, and Memory in Biological Systems.** Communication and memory in biological systems: in voltage sensitive ion channels, hormone-receptor interactions, and initiation and control of RNA/DNA synthesis. Models of signaling and memory are developed and related to electronic signaling schemes. Prerequisites: Computer Science 102, two semesters of college chemistry, and four semesters of college mathematics. 3 units. *Starmer*

#### For Graduates

**308. Advanced Topics in Digital Systems.** See C-L: Electrical Engineering 308. 3 units. *Marinos*

**310. CMOS VLSI Design.** A second course in VLSI, aimed at the design of VLSI systems in CMOS. The main thrusts of the course will be (1) to provide enough background in the theory of CMOS circuits to understand circuit level trade-offs; (2) to introduce a symbolic design system and its supporting software, which greatly aid the design process; (3) to examine sample chip designs with an eye to understanding competitive design methodologies. Students will complete a CMOS-oriented project comprising the design and implementation of either a hardware or a software subsystem. Prerequisite: Computer Science 210 or equivalent. C-L: Electrical Engineering 310. 3 units. *Kedem*

**315. Advanced Topics in Artificial Intelligence.** Course content will vary from year to year and will include a detailed study of one or more of the following: mechanical theorem proving, natural language processing, automatic program synthesis, machine learning and inference, representations of knowledge, languages for artificial intelligence research, artificial sensorimotor systems, and others. Prerequisite: Computer Science 215. 3 units. *Biermann, Loveland, or Nadathur*

**316. Computational Linguistics.** A historical and technical introduction to the computer processing of English or other natural language inputs, with emphasis on such applications as data base query, programming, and office automation. Topics will include techniques for the morphological, syntactic, semantic, and pragmatic analysis of English. Recent developments in the area will also be studied. Students will write a short paper and/or do a project. Prerequisite: Computer Science 215. 3 units. *Biermann*

**320. VLSI Algorithmics.** Algorithmic and systems aspects of VLSI. Topics include theoretical studies of the layout problem, array logic, placement and routing, fault-tolerance in VLSI designs, design for testability, the design of networks of processors, and cost trade-offs in VLSI designs. Each student will complete an in-depth study of a

topic approved by the instructor. Prerequisites: Computer Science 224 and either 210 or 310. 3 units. *Staff*

**321. Topics in Numerical Mathematics.** Advanced topics in numerical mathematics to be selected from areas of current research. Prerequisites: Computer Science 221 and 222. 3 units. *Gardner, Greenside, Rose, or Szyld*

**326. Systems Modeling.** Advanced study of analytical models of systems; queuing model and its parameterization and validation. Methods for computer solutions of some models. Prerequisites: Computer Science 226 and 231. 3 units. *Trivedi*

**331. Operating Systems Theory.** Advanced study of theoretical aspects of operating systems emphasizing models and control of concurrent processes, processor scheduling, and memory management. Prerequisites: Computer Science 226 and 231. 3 units. *C. Ellis, Trivedi, or Wagner*

**381. Seminar in Computer Systems Analysis.** Topics in computer systems analysis, especially for fault-tolerant systems, including reliability, availability and performance analysis, comparative analysis of architectures, performability, analytic and numerical solution techniques, stochastic Petri nets, simulation. 1 to 3 units. *Dugan or Trivedi*

**382. Seminar in Artificial Intelligence.** Topics in artificial intelligence, such as natural language understanding, learning, theorem proving and problem solving, search methodologies. Topics will vary from semester to semester. Includes research literature reading with student presentation. 1-3 units. *Staff*

#### COURSES CURRENTLY UNSCHEDULED

301. Topics in Programming Theory

325. Theory of Computation

332. Topics in Operating Systems

#### SUPPLEMENTARY COURSES OFFERED AT UNC-CH

Comp 145. Software Engineering Laboratory

Comp 171. Natural Language Processing

Comp 230. File Management Systems

Comp 236. Computer Graphics

Comp 238. Raster Graphics

Comp 254. Picture Processing and Pattern Recognition

Comp 265. Architecture of Computers

## Cultural Anthropology

Professor Friedl, *Chairman and Director of Graduate Studies* (114 Social Sciences); Professors Apte, Fox, and O'Barr; Associate Professors Domínguez, Quinn, and Smith; Professor Emeritus La Barre; Adjunct Professor Cartmill

The department offers graduate work leading to the Ph.D. degree in cultural anthropology. Applicants for admission should submit scores on the Graduate Record Examination Aptitude Test. Admission to the program is not contingent on previous anthropological course work or any other specific program of study at the undergraduate level.

The department offers a program of specialization in social/cultural anthropology. The emphasis of the social/cultural anthropology program is the application of a theo-

retical and comparative perspective to research in complex societies. Within this perspective, a wide range of interests is represented in the department.

Curriculum is tailored to the individual student's background, academic needs, and research goals; pursuit of relevant cross-disciplinary study, within and outside the department, is expected. However, a modest number of courses is required of all students, and a reading knowledge of one foreign language is required of all doctoral students. Candidates for the Ph.D. degree must demonstrate competence in their chosen subfield of specialization and knowledge of the broad theoretical perspectives, from all disciplines relevant for their area of concentration.

Further details of the graduate program in anthropology, the departmental facilities, the staff, and various stipends available are described in the *Guidelines for Graduate Students in Anthropology* which may be obtained from the Director of Graduate Studies, Department of Anthropology.

### For Seniors and Graduates

**201S. Marxism and Anthropology.** The interaction of Marxist and anthropological theory over the last half century; particular attention to evolution, historical transformation, mode of production, labor processes, culture, ideology, and consciousness. 3 units. *Smith*

**204S. The Anthropology of Cities.** Organization and behavior in urban centers from an evolutionary perspective; cross-cultural analysis of cities. Prerequisite: Cultural Anthropology 94. 3 units. *Fox or Smith*

**206S. Current Theoretical Schools in Anthropology.** The theoretical schools since World War II, including cultural materialism and neo-Marxism, structuralism, cognitive anthropology, cultural analysis and symbolic anthropology, transactional analysis, and sociobiology. Prerequisite: Cultural Anthropology 94 or graduate standing or consent of instructor. 3 units. *Apte, Domínguez, Fox, O'Barr, Quinn, or Smith*

**211S. Ethnography of Communication.** History of the mutual influence of linguistics and anthropology leading to the development of ethnography of speaking, ethno-science, structuralism, and sociolinguistics. Topics vary each semester. Prerequisite: Cultural Anthropology 111 or 119 or consent of instructor. 3 units. *Apte, Domínguez, or O'Barr*

**215S. The Anthropology of Women: Theoretical Issues.** Topic to be selected each semester from: gender ideology, women and work, gender inequality, the history of feminist anthropology, or others. C-L: Women's Studies. 3 units. *Domínguez, Quinn, or Smith*

**228S. Slavery and Society.** Western and non-Western systems of slavery and their effects on social organization, self-concepts, and race relations. 3 units. *Domínguez*

**234S. Political Economy of Development: Theories of Change in the Third World.** See C-L: Political Science 234S; also C-L: History 234S and Sociology 234S. 3 units. *Fox, Gereffi, or Smith*

**239. Culture and Ideology.** Major theories about the relationship between ideologies and social/economic systems. Readings from the works of Marx, Weber, Gramsci, Althusser, Geertz, and others. 3 units. *Fox or Smith*

**251S. American Marriage: A Cultural Approach.** Individual research on the American cultural model of marriage. Collection, transcription, and analysis of how individuals adapt it to understanding their own experiences. C-L: Women's Studies. 3 units. *Quinn*

**255S. Heroes and Heroics: Culture and the Individual.** Can great men or women change the course of cultures? Or are even those we call geniuses and heroes simply carriers of their culture? The relationship between individuals and their cultures as portrayed



in anthropology and related disciplines. Various approaches to the lives of selected heroes, using M. K. Gandhi as an exemplar. 3 units. *Fox*

**258S. Symbols in Society.** Symbolic action and expressive culture among tribal, peasant, and industrial societies. Approaches emphasized are functionalism, symbolic interaction, structuralism, and cultural interpretation. 3 units. *Apte or Domínguez*

**267. Cognitive Anthropology.** The organization of culturally shared knowledge; cognitive tasks such as categorizing, decision making, problem solving, and reasoning. 3 units. *Quinn*

**272S. Marxism and Feminism.** Introduction to the theoretical literature and debates linking Marxism and Feminism. Prerequisite: consent of instructor. C-L: Women's Studies. 3 units. *Smith*

**282S. Canada.** See C-L: History 282S; also C-L: Political Science 282S and Sociology 282S. 3 units. *Cahow*

**284S. Feminist Theory and the Social Sciences.** See C-L: History 284S; also C-L: Political Science 264S, Psychology 284S, Sociology 284S, and Women's Studies. 3 units. *Chafe, Neuschel, O'Rand, C. Smith, or Spenner*

### For Graduates

**330S, 331S. Theories in Sociocultural Anthropology.** A two-semester seminar in anthropological theory, in which the modern currents and debates in the field are examined and discussed. Particular topics to be chosen by the instructors. 6 units. *Staff*

**393. Individual Research in Anthropology.** Supervision and guidance of A.M. thesis preparation, Ph.D. dissertation preparation, or other intensive research on a selected problem. 3 units. *Staff*

### COURSES CURRENTLY UNSCHEDULED

**205. The Anthropology of Anthropology**

**237S. Interpretations of Kinship**

**275S. Inequality in Precapitalist Societies**

## Economics

Professor Vernon, *Chairman* (215A Social Sciences); Professor Wallace, *Director of Graduate Studies* (238 Social Sciences); Professors Clotfelter, Coats, Cook, Davies, de Marchi, Geweke, Gillis, Goodwin, Grabowski, Graham, Havrilesky, Henderson, Kelley, Krueger, Lewis, McElroy, Naylor, Tauchen, Tower, Trembl, Viscusi, Weintraub, and Yohe; Associate Professors Kimbrough and Marshall; Assistant Professors Baumgardner, Brock, Meurer, and Pessino; Adjunct Professors Bates, Gallant, Ladd, and Richard

The Department of Economics offers graduate work leading to the A.M. and Ph.D. degrees. Among the undergraduate courses of distinct advantage to the graduate student in economics are statistics, economic theory, and basic courses in philosophy, mathematics, and social sciences other than economics. Advanced work in mathematics or statistics is also useful.

Requirements for the Ph.D. degree in economics include courses in economic theory and econometrics in the first year. By the beginning of the third year, the student must have passed a core examination in economic analysis. In addition, a student must obtain certification in three fields, one of which may be in an outside minor. The student may select from advanced economic theory, history of political economy, economic development, economic history, international economics, money and banking, labor econom-

ics, public finance, industrial organization, econometrics, Soviet economics, and certain fields outside the economics department (e.g., statistics, demography). Course work for the Ph.D. degree should be completed in five or six semesters of residence.

### For Seniors and Graduates

**200. Capitalism and Socialism.** Selected ideological classics of new and old, right and left economics including both "counsels for perfection" (utopias) and "precepts for action" in political economy. Prerequisites: Economics 149 and 154 or consent of instructor. 3 units. *Naylor*

**204S. Advanced Monetary Economics.** Monetary theory and its statistical and institutional implementation. Particular attention to the development of aggregative theories of prices, interest rates, and production; the functioning of monetary policy within various theoretical frameworks; appraisal of recent use and limitations of Federal Reserve policy. Prerequisite: Economics 153. 3 units. *Havrilesky or Yohe*

**205S. Advanced Monetary Theory and Policy.** Emphasis on recent issues: innovations in the payments mechanism and new monetary aggregates, the subterranean economy, financial crises, alternative views of the monetary policy transmission mechanism, and the monetarist-fiscalist controversy. Prerequisites: Economics 138 and 153. 3 units. *Havrilesky or Yohe*

**212S. Economic Science and Economic Policy.** A historical examination of the impact of economics on public policy; topics vary each semester and have included energy and anti-inflation policy, productivity growth, the Third World, and the Council of Economic Advisers. 3 units. *Goodwin or Henderson*

**213S.1. The Economics of Slavery in the American South.** The nature, development, economics, and social consequences of slavery in the United States during the nineteenth century. Prerequisites: Economics 149 and consent of instructor. 3 units. *Coats*

**214. Social Choice.** The economic study of nonmarket decision making. Theory of constitutions, voting rules, voter behavior, the bureaucracy, incentives for reaching consensus, and the evolution of cooperation. Applications to the provision of public goods, and tax policy and redistribution. Available only in the Duke in Amsterdam Summer Program. Prerequisites: Economics 1 or 51, 2 or 52. 3 units. *de Marchi*

**214S. Social Choice.** A seminar version of 214. Prerequisites: Economics 149 and consent of instructor. 3 units. *de Marchi*

**215S. Applied Welfare Economics.** The principles of economic cost benefit analysis applicable to circumstances in which market valuations do not provide adequate measures of social desirability. Socially relevant prices for labor, capital, energy, materials, foreign exchange, and valuation of public goods. Development of analysis for individual projects, extended to cover economic policies. Prerequisite: Economics 149. 3 units. *Henderson*

**218. Macroeconomic Policy.** See C-L: Public Policy Studies 218. 3 units. *Staff*

**219S. Economic Problems of Underdeveloped Areas.** Analysis of underdeveloped countries with some attention to national and international programs designed to accelerate development. Prerequisite: Economics 149 or consent of instructor. 3 units. *Kelley or Naylor*

**220S. Computer Modeling for Policy Analysis.** Introduction to the use of computer techniques in economic policy evaluation; policy applications to international economics, public finance and development economics; computer analysis of linear and nonlinear models. Students required to complete a major modeling project. Prerequisites: Economics 149 and Economics 154. 3 units. *Tower*

**232. Microeconomics: Policy Applications.** See C-L: Public Policy Studies 232. 3 units.  
*Ladd*

**233. Public Sector Economics and Policies.** Analysis of expenditures, taxation, debt, public enterprises, and current government programs. Prerequisite: Economics 149 or consent of instructor. 3 units. *Staff*

**239. Introduction to Econometrics.** Data collection, estimation, and hypothesis testing. Use of econometric models for analysis and policy. (Not open to students who have had Economics 139.) Prerequisites: Economics 2 or 52 and Mathematics 32 or equivalent and Economics 138 or equivalent. 3 units. *McElroy, Pessino, Tauchen, or Wallace*

**243. Econometrics I.** Economic theory, mathematics, statistical inference, and electronic computers applied to analysis of economic phenomena. Objective is to give empirical content to economic theory. Matrix algebra used to develop topics in inference, linear regression, and systems of simultaneous equations. Use is made of the electronic computer. Prerequisites: Economics 149 and 237 or equivalents. 3 units. *Geweke, Marshall, or Wallace*

**244. Corporate Economics I.** Strategic planning models of the firm including marginal analysis, mathematical programming, portfolio, and corporate simulation models. Economics as the language of corporate planning and modeling. Prerequisites: Economics 138 and 149 or equivalents. 3 units. *Naylor*

**245. Econometrics II.** Advanced theory and applications: includes specification error, generalized least squares, lag structures, Bayesian decision making, simultaneous equation methods, and forecasting. Emphasis on current applied literature. Prerequisite: Economics 243. 3 units. *Geweke or Tauchen*

**246. Selected Topics in Econometric Theory.** Analysis of panel data, combining data from different sources, vector autoregressive methods, problems of causation in time series data, nonlinear estimation, limited dependent variables, sample selection bias, and other topics to be chosen subject to the interests of the class. 3 units. *Geweke, Richard, or Tauchen*

**247S. Applied Econometrics.** Application of current developments in econometric methodology to empirical problems in economics. Emphasis on the conduct of empirical research, including model and hypothesis formulation, testing, and integration of economic and econometric theory. 3 units. *McElroy, Pessino, and Wallace*

**249. Microeconomics.** Cost and supply considerations in price theory; the demand for factors of production. The allocation of resources in the context of competitive and monopolistic market structures. (Not open to students who have taken Economics 149.) Prerequisites: Economics 2 or 52 and Mathematics 31. 3 units. *Staff*

**250S. Modern Economic Thought.** Integrated survey of the several major streams of economic theory since 1936. Selected topics from the economics of Keynes, its offshoots and coordinate developments, and post-Marxian economic theory. Historical evolution of recent ideas and their interrelations. Prerequisite: Economics 138 and 149 and 154 or consent of instructor. 3 units. *de Marchi or Weintraub*

**254. Macroeconomics.** Concepts and measurement of national income and expenditures, employment interest rates, and price levels; the theoretical determination of these aggregates, applications of macroeconomic growth. (Not open to students who have taken Economics 154.) 3 units. *Staff*

**265S. International Trade and Finance.** Fundamental principles of international economic relations. The economic basis for international specialization and trade and the economic gains from trade, the balance of international payments, problems of interna-



tional finance, investments, and monetary problems. Prerequisites: Economics 149 and 154. 3 units. *Brock, Kimbrough, Krueger, or Tower*

**268. Federal Tax Policy.** See C-L: Public Policy Studies 268. 3 units. *Clotfelter or Schmalbeck*

**270S. Fundamentals of Political Economy.** See C-L: Political Science 270S. 3 units. *Aldrich, Bates, or Bianco*

**286S. Economic Policy-Making in Developing Countries.** See C-L: Public Policy Studies 286S. 3 units. *Conrad or Gillis*

**287. Public Finance.** Economic aspects of such problems as the growth of government, the proper role of the state, the centralization and decentralization of government, government bureaucracy, the impact of taxes and spending on the wealthy and the poor, other public policies and questions. Prerequisite: Economics 149. 3 units. *Staff*

**293. Soviet Economic History.** Establishment of foundations of a socialist economy: collectivization, industrialization, and search for economic efficiency. 3 units. *Trembl*

**294S. Soviet Economic System.** Economic planning and administration in the Soviet Union and other socialist countries. International comparisons. Theoretical and applied problems of resource allocation, economic development, and optimal micro decision-making in a nonmarket economy. 3 units. *Trembl*

#### For Graduates

**301. Microeconomic Analysis I.** Review of contemporary theory relating to production, the firm, and income distribution in competitive and imperfectly competitive markets. 3 units. *Tower*

**302. Microeconomic Analysis II.** A continuation of Economics 301 with emphasis on analyses of consumer behavior, general equilibrium, welfare economics, and capital theory. Prerequisite: Economics 301. 3 units. *Graham*

**304, 305. Monetary Theory and Policy.** 304: theories of the supply of and demand for money (neoclassical and Keynesian macroeconomic), general equilibrium theories, and theories of the term structure of interest rates. 305: the theory and practice of monetary policy with emphasis on recent issues, the monetarist-fiscalist controversy, the monetary policy transmission mechanism, and policy simulations with econometric models. 3 units each. *Havrilesky, Kimbrough, or Yohe*

**309. Trade and Development Theory.** Theory of international trade and trade policy as it affects the structure and growth of individual economies, with emphasis on developing countries. Comparative advantage, factor proportions explanation of trade, infant industry and other arguments for protection, interactions of exchange rate and trade policy and special issues relating to primary commodities are examined. 3 units. *Krueger*

**311, 312. History of Political Economy.** A detailed review of the development of economic theory, the tools of economic analysis, and economics as a science, together with an analysis of the circumstances affecting this development. Period covered: pre-Christian times through 1936. 3 units each. *Goodwin*

**313, 314. Seminar in Economic Theory.** Prerequisite: Economics 301 or equivalent. 3 units each. *Weintraub*

**317. Seminar in Demographic, Population, and Resource Problems (Development Economics I).** Historical, empirical, and theoretical topics in development economics focusing on real aspects of growth in a closed economy. Special attention to human

resource economics (demography, education, nutrition), models of dualism, agricultural growth, and technology. 3 units. *Brock or Kelley*

**319. Seminar in the Theory and the Problems of Economic Growth and Change (Development Economics II).** Links between aid, financial markets, and real investment in an open economy stressing tariff protection and capital controls (internal and external). Economic policy-making using market solutions and/or planning models (input-output, linear programming, and computable general equilibrium). 3 units. *Brock*

**320. Macroeconomic Analysis I.** Measurement of national income and other important aggregates; classical macroeconomics; Keynesian and more recent views of the determinants of income, employment, and price levels; empirical studies of consumption, investment, and monetary variables. 3 units. *Kimbrough or Tauchen*

**322. Macroeconomic Analysis II.** Further analysis of topics treated in Economics 320. Optimal economic growth; business cycles. Issues in economic policy. Prerequisite: Economics 320. 3 units. *Kimbrough or Tauchen*

**326. Stochastic Macroeconomics.** Advanced topics in macroeconomics with an emphasis on empirical macroeconomics and the interrelationship between economic theory and empirical work in macroeconomics. Topics include the interpretation of macroeconomic time series, formulating and testing models of asset pricing and market efficiency, solution and estimation of rational expectations models, vector autoregression models, and policy evaluation with empirical macroeconomic models. 3 units. *Tauchen*

**329. Federal Finance.** An analysis of the trends and hypotheses concerning the growth in governmental activity, the optimum level and composition of governmental spending, and the microeconomic and macroeconomic effects of governmental spending and tax policies. 3 units. *Clotfelter or Viscusi*

**330. Seminar in Public Finance.** 3 units. *Viscusi*

**350. Modern Economic Thought.** Principles of microeconomics in the analysis of problems and policies. The particular contextual materials that will be subjected to analysis will vary. Materials will be treated in the tradition of positive economics. 3 or 6 units. *Staff*

**355. Seminar in Labor Economics.** 3 units. *Baumgardner or McElroy*

**358. Seminar in Labor Market and Related Analysis.** 3 units. *Baumgardner or McElroy*

**359. Economic Analysis of Legal Issues.** An exploration of diverse topics in law and economics such as property rights and externalities, tort law and optimal accident prevention, bargaining and game theory, the economics of contracts, and theories of economic justice. 3 units. *Culp*

**365. Seminar in International Trade Theory and Policy.** 3 units. *Tower*

**366. Seminar in International Monetary Theory.** 3 units. *Kimbrough*

**380. Graduate Economics Workshops.** For postpreliminary students. May be taken for multiple credit. Sections: 01. Industrial Organization and Regulation; 02. International Economics; 03. Labor Economics; 04. Macroeconomics; 05. Public Finance; 06. Economic Thought; 07. Corporate Economics; 08. Applied Econometrics. 3 units each. *Staff*

**388. Industrial Organization.** The theory, measurement, and history of the firm-structure of industry. Emphasis upon the structure of American industry and upon actual production and pricing practices. Criteria for evaluating industrial performance. 3 units. *Grabowski, Meurer, or Vernon*

389. Seminar in Industrial and Governmental Problems. 3 units. *Grabowski, Marshall, or Vernon*

397, 398. Directed Research. 3 units. *Staff*

#### COURSES CURRENTLY UNSCHEDULED

234. Urban and Regional Economics

235. The Economics of Crime, Law Enforcement, and Justice

285. Evaluation of Public Expenditures

303. Theory of Economic Decision Making

307. Quantitative Analysis I

308. Quantitative Analysis II

316. Seminar in Economics of Soviet-Type Socialism

321. Theory of Quantitative Economic Policy

323. Income Distribution Theory

324, 325. Economics of the Law

331. Seminar in Economic History

345, 346. Demographic Techniques I and II

401. Seminar on the British Commonwealth

402. Interdisciplinary Seminar in the History of the Social Sciences

#### RELATED COURSES IN OTHER DEPARTMENTS

Courses in related fields may be selected from anthropology, computer science, forestry, history, mathematics, philosophy, political science, public policy sciences, sociology, and statistics or from an area that complements the candidate's area of research interests in economics.

See the Center for Demographic Studies in the chapter "Special and Cooperative Programs" for further information.

## Education

Associate Professor Davis, *Chairman and Director of Graduate Studies* (213 West Duke); Professor Page; Associate Professors Ballantyne, Carbone, Di Bona, Johnson, and Sawyer; Professor Emeritus Gehman; Adjunct Associate Professors Martin and Pittillo; Adjunct Assistant Professor Mayesky; Lecturer Fowler

For students admitted to graduate programs prior to fall 1981, specific requirements may be obtained in the Graduate School office. Qualified juniors, seniors, and graduate students may enroll in appropriate education courses as electives.

#### For Seniors and Graduates

205, 206. Selected Topics. Three units each. *Staff*

215S. Seminar in Secondary School Teaching. Principles, practices, and problems in secondary school instruction. 3 units. *Carbone or staff*

216. Secondary Education: Internship. Supervised internship in senior high schools involving some full-time teaching. For student teachers only. 6 units. *Carbone or staff*



**225. The Teaching of History and the Social Studies.** Evaluation of the objectives, content, materials, and methods in the teaching of history and the social studies. 3 units. *Carbone or staff*

**232. Learning and Living in Families.** Role and function of the family as related to the development and behavior of its members, to gender identification, to parenting, and to interactions among family members. 3 units. *Ballantyne or Davis*

**236. Teaching Developmental and Remedial Reading in the Secondary School.** Principles, methods, and materials for the development of effective reading attitudes and skills in developmental and remedial programs. 3 units. *Staff*

**242S. Group Interactions.** Examination of theoretical issues and processes involved in the dynamics of, and learning in, small groups of children, adolescents, parents, other adults, with attention to problem-oriented groups. 3 units. *Ballantyne*

**246. Teaching of Mathematics.** Aims, curriculum, and classroom procedure for teaching secondary school mathematics. 3 units. *Staff*

**276. Teaching of High School Science.** Discussion, lectures, and collateral reading related to such topics as aims, tests, curriculum, classroom and laboratory procedure, field trips, and course and lesson planning for secondary school science. 3 units. *Staff*

### For Graduates

**350, 351. Directed Activities in Education.** Internship experiences at an advanced level under supervision of appropriate staff. Prerequisite: consent of instructor. 3 units each. *Staff*

**357. Directed Research.** For students who have passed the preliminary examination. 1 to 6 units. *Staff*

### COURSES CURRENTLY UNSCHEDULED

211. Education and the Mass Media

212S. Pedagogy and Political Economy: A World View

227. Contemporary Theories of Counseling and Psychotherapy

248. Practicum in Counseling

## Engineering

Earl H. Dowell, Sc.D., *Dean* (305 Teer Engineering Library Building)

Jack B. Chaddock, Sc.D., *Associate Dean for Research* (305 Teer Engineering Library Building)

The School of Engineering offers programs of study and research leading to the M.S. and Ph.D. degrees with a major in biochemical, biomedical, civil and environmental, electrical, and mechanical engineering and materials science. These programs are designed to provide: (1) development of depth and breadth in mathematics, computer science, the basic physical sciences, the life sciences where appropriate, and the engineering sciences; (2) mastery of an advanced body of knowledge in the candidate's chosen field of specialization or research; (3) experience in the art of engineering, including strong elements of intuition, imagination, and judgment; and (4) performance of original research which, in the case of the M.S. degree, demonstrates the ability to advance knowledge in the area of professional study and, in the case of the Ph.D. degree, makes a significant contribution to the research literature through publication in a leading professional journal in the field. Engineering graduate students are expected to participate in seminars appropriate to their fields of study. A minimum of 30 units of earned graduate credit beyond the

bachelor's degree is required for the M.S. degree: 12 in the major, 6 in related minor work (usually mathematics or natural science), 6 in either the major or minor subject or in other areas approved by the major department, and 6 for a research-based thesis. A nonthesis option requiring 30 units of course credit is available. Each of the departments imposes additional requirements in the exercise of this option. There is no language requirement for this degree. A minimum of 60 units of earned graduate credit beyond the bachelor's degree is required for the Ph.D. degree. In civil and environmental engineering, 12 units of course work beyond the master's degree are required to be in the major field, 6 in a related minor field, and 6 in either the major or minor field; in electrical engineering, 24 units are required in the major field and 12 units in a related minor field (often mathematics or natural science), 12 in either the major or minor subject or other areas approved by the major department, and 12 for a research-based dissertation. In biomedical and mechanical engineering and materials science there are no specific course requirements; each program is planned to meet individual needs. Doctoral students are required to pass qualifying and preliminary examinations which may be either written, oral, or a combination of written and oral components, at the discretion of the committee and the department.

The Center for Biochemical Engineering offers both M.S. and Ph.D. degrees in biochemical engineering. Further details about this program may be found in the chapter "Special and Cooperative Programs" in this bulletin or obtained from the Director of Graduate Studies, Center for Biochemical Engineering.

In addition, the School of Engineering and the Fuqua School of Business offer an MBA/MS Joint-Degree Program. Further details about this program may be obtained from: Professor Eric Pas, Director, MBA/MS Joint-Degree Program, Department of Civil and Environmental Engineering.

## ENGINEERING

**221. Computational Linear Algebra.** Linear vector spaces of real and complex  $n$ -tuples, norms, metrics, inner-products, basis vectors, rank and dimensionality; matrices as linear maps, rank and nullity, particular and general solutions of  $Ax=b$ ; LR, LDU, and QR type factorization of matrices by direct methods and successive transformations (using ordinary, unitary, Hermitian unitary elementary matrices); solution of  $Ax=b$  by direct methods using the factors, and iterative methods (Jacobi, Gauss-Seidel, SOR, Lanczos type); iterative solutions of nonlinear equations; special and general eigenvalue problems; tridiagonalization by similarity transformations (Givens, Householder, Lanczos type); diagonalization by Jacobi, LR, QR type algorithms; power methods; computational complexities, storage requirements, convergence characteristics, and the mathematical basis of the studied algorithms. Prerequisites: undergraduate mathematics requirement of the School of Engineering, knowledge of any algorithmic programming language. 3 units. *Utku*

**222. Computer Solutions of Ordinary and Partial Differential Equations.** Ordinary differential equations; initial value problems; Lipschitz conditions; single and multistep methods; predictor-corrector methods; stability and error control; elliptic partial differential equations; linear boundary value problems, solutions by finite differences and finite elements; parabolic differential equations, initial value problems, solutions by successive boundary value problems, stability and error control; hyperbolic differential equations; propagation of discontinuities; method of characteristics. Prerequisites: Engineering 221 or consent of instructor. 3 units. *Utku*

## BIOMEDICAL ENGINEERING

Professor McElhane, *Chairman* (136 Engineering); Professor von Ramm, *Director of Graduate Studies* (267 Engineering Annex); Professors Barr, Clark, Hammond, Hochmuth, Nolte, Pilkington, Plonsey, Thurstone, and Wolbarsht; Associate Professors Burdick, Jaszczak,

and Pasipoularides; Assistant Professors Cusma, Daniels, Floyd, Jacobs, Reichert, Smith, Trahey, and Truskey

Biomedical Engineering is the discipline in which the physical, mathematical, and engineering sciences and associated technology are applied to biology and medicine. Contributions range from modeling and simulation of physiological systems through experimental research to solutions of practical clinical problems. The goal of the graduate program in biomedical engineering is to combine training in advanced engineering, biomedical engineering, and the life sciences so that graduates of the program can contribute at the most advanced professional level. The doctoral dissertation should demonstrate significant and original contributions to an interdisciplinary topic, accomplished as an independent investigator. The major, current research areas are: biochemical engineering, biofluid mechanics, biomechanics, biomedical materials, biomedical modeling, biosensors, biotechnology, data acquisition and processing, medical imaging, and electrophysiology. Every biomedical engineering graduate student is required to serve as a teaching assistant as part of the graduate training.

**201. Electrophysiology.** The electrophysiology of excitable cells from a quantitative perspective. Topics include the ionic basis of action potentials, the Hodgkin-Huxley model, impulse propagation, source-field relationships, and an introduction to functional electrical stimulation. Student chooses a relevant topic area for detailed study and report. Not open to students who have taken Biomedical Engineering 101 or equivalent. 3 units. *Barr or Plonsey*

**202. Biomedical Transfer Processes.** An introduction to biomedical diffusion and momentum transfer with particular emphasis on physical models of biological and artificial organ systems. 3 units. *Clark and Hochmuth*

**205, 206. Microprocessors and Digital Instruments.** Design of microcomputer-based devices including both hardware and software considerations of system design. Primary emphasis on hardware aspects, including a progression through initial design, prototype construction in the laboratory, testing of prototypes to locate and correct faults, and final design evaluation. Evaluation includes examination of complexity, reliability, and cost. Design and construction oriented toward biomedical devices or instruments that include dedicated microcomputers, usually operating in real time. Prerequisites for 205: Engineering 51 and Biomedical Engineering 163, 164 or equivalents; for 206: satisfactory work in 205. 4 units each. *Barr, Hammond, and von Ramm*

**207. Transport Phenomena in Biological Systems.** An introduction to the modeling of complex biological systems using principles of advanced transport and kinetic process analyses. A continuum approach will be used to analyze multicomponent mass transport and reactions in systems found in biotechnological and biomedical applications. Systems considered will include facilitated versus active transport of nutrients across membranes, lung oxygen transport models, artificial kidney design (external membrane dialysis and peritoneal dialysis), electrophoresis, pulsatile flow in arterial systems, attached enzyme reactions, and microbial adhesion to solid surfaces. C-L: Civil Engineering 207 and Mechanical Engineering 207. 3 units. *Bryers, Daniels, or Truskey*

**211. Theoretical Electrophysiology.** Mathematical analysis of intracellular and extracellular currents and voltages arising from subthreshold and transthreshold stimuli applied to excitable tissue (cardiac and striated muscle and nerve). Bases for and behavior of models of excitable tissue utilizing discrete and continuous formulations. Evaluation of sources of extracellular fields. Description of, and evaluation of, models of membrane behavior. Laboratory exercises based on computer simulation, with emphasis on quantitative behavior and design. Readings from original literature. Prerequisite: Biomedical Engineering 101 or 201. 4 units. *Barr and Plonsey*



**212. Theoretical Electrocardiography.** Mathematical analysis of currents flowing between the heart and body surface. Cardiac electrophysiology. Consideration of cardiac models, inhomogeneities, and surface lead systems. Examination of lead systems, and the interpretation of body surface measurements using inverse calculations. Laboratory exercises based on computer simulation with emphasis on quantitative behavior and design. Readings from the original literature. Prerequisite: Biomedical Engineering 101 or 201. 4 units. *Barr and Plonsey*

**215. Biomedical Materials and Artificial Organs.** Chemical structures, processing methods, evaluation procedures, and regulations for materials used in biomedical applications. Applications will include implant materials, components of *ex vivo* circuits, and cosmetic prostheses. Primary emphasis will be placed on polymer-based materials and on optimization of parameters of materials which determine their utility in applications such as artificial kidney membranes and artificial arteries. Prerequisite: Engineering 83 or Chemistry 151 or consent of instructor. C-L: Mechanical Engineering 215. 3 units. *Clark*

**216. Transport Phenomena in Cells and Organs.** Applications of the principles of mass and momentum transport to the analysis of selected processes of biomedical and biotechnological interest. Emphasis placed on the development and critical analysis of models of the particular transport process. Topics discussed include: reaction-diffusion process, transport in natural and artificial membranes, dynamics of blood flow, pharmacokinetics, receptor-mediated processes and macromolecular transport normal and neoplastic tissue. Prerequisite: Biomedical Engineering 207 or equivalent. 3 units. *Truskey*

**222. Principles of Ultrasound Imaging.** Propagation, reflection, refraction, and diffraction of acoustic waves in biologic media. Topics include geometric optics, physical optics, attenuation, and image quality parameters such as signal-to-noise ratio, dynamic range, and resolution. Emphasis is placed on the design and analysis of medical ultrasound imaging systems. Prerequisites: Physics 52 and Mathematics 111. 3 units. *von Ramm*

**230. Biomechanics.** Basic elements of mechanics are developed with application in biomechanics. Primary emphasis is given to trauma mechanisms, injury criteria, and human protection. Head and neck injuries and helmet design are discussed. Case studies from product liability lawsuits with a strong biomechanics context are discussed in a seminar mode. 3 units. *McElhanev*

**233. Modern Diagnostic Imaging Systems.** The underlying concepts and instrumentation of several modern medical imaging modalities. Review of applicable linear systems theory and relevant principles of physics. Modalities studied include X-ray radiography (conventional film-screen imaging and modern electronic imaging), computerized tomography (including the theory of reconstruction), and nuclear magnetic resonance imaging. Prerequisite: consent of instructor. 3 units. *Cusma or Floyd*

**235. Acoustics and Hearing.** This course covers the generation and propagation of acoustic (vibrational) waves and their reception and interpretation by the auditory system. Topics under the heading of generation and propagation include free and forced vibrations of discrete and continuous systems, resonance and damping, and the wave equation and solutions. To understand the reception and interpretation of sound, the anatomy and physiology of the mammalian auditory system are presented, and the mechanics of the middle and inner ears studied. Prerequisites: Physics 52 and Mathematics 111 or equivalents. 3 units. *Trahey*

**241. Artificial Intelligence in Medicine.** Basic concepts of Artificial Intelligence (AI) and in-depth examination of medical applications of AI. Knowledge of heuristic program-

ming; brief examination of the classic AI programming languages (LISP and PROLOG) and AI programming; a study of rule-based systems and cognitive models. 3 units. *Hammond*

**243. Computers in Biomedical Engineering.** An in-depth study of the use of computers in biomedical applications. Hardware, software, and applications programming. Data collection, analysis, and presentation studied within application areas such as monitoring, medical records, computer-aided diagnoses, computer-aided instruction, M.D.-assistance programs, laboratory processing, wave form analysis, hospital information systems, and medical information systems. 3 units. *Hammond*

**244. Mathematical Models of Physiological Systems.** Mathematical modeling and computer simulation of physiological and other biomedical systems. Formulation of quantitative models of physiological processes using methods drawn from a variety of engineering disciplines including transport phenomena, feedback control, and continuum mechanics. Digital techniques for the solution of coupled nonlinear equations, emphasizing systems of ordinary and partial differential equations. Selected readings from the literature covering current models of cardiovascular, renal, neural, respiratory, and sensory systems. Prerequisite: Mathematics 111 or equivalent. 3 units. *Daniels*

**265. Advanced Topics in Biomedical Engineering.** Advanced subjects related to programs within biomedical engineering tailored to fit the requirements of a small group. Prerequisites: consent of instructor. 1 to 4 units. *Staff*

#### For Graduates

**333. Biomedical Imaging.** A study of the fundamentals of information detection, processing, and presentation associated with imaging in biology and medicine. Analysis of coherent and incoherent radiation and various image generation techniques. Also covered will be the psychometrics of image evaluation dealing with subjective and objective parameters. Emphasis will be placed upon sonography, thermography, X-ray, various forms of nuclear radiography, microscopy, and holography. 3 units. *von Ramm*

**399. Special Readings in Biomedical Engineering.** Individual readings in advanced study and research areas of biomedical engineering. Prerequisite: approval of Director of Graduate Studies. 1 to 3 units each. *Staff*

#### COURSES CURRENTLY UNSCHEDULED

**204. Measurement and Control of Cardiac Electrical Events**

**221. Electrophysiological Techniques**

**311. Inverse Models**

#### CIVIL AND ENVIRONMENTAL ENGINEERING

Professor Vesilind, *Chairman* (121 Engineering); Associate Professor Peirce, *Director of Graduate Studies* (122 Engineering); Professors Haff, Melosh, Petroski, S. Utku, Vesilind, and J. F. Wilson; Associate Professors Biswas, Bryers, Hueckel, Medina, Pas, and Reckhow; Assistant Professors Faust and Jacobs; Adjunct Professors Kranich and B. Utku

A student may specialize in one of the following fields of study for either the M.S. or the Ph.D. degree: environmental engineering; geotechnical engineering and soil mechanics; mechanics of solids; materials engineering; fluid mechanics and water resources; structural engineering; and urban systems and transportation. Interdisciplinary programs combining study in some of the major areas with biological, chemical, and physical sciences, business administration, materials science, social sciences, political science, public policy studies, and other areas of engineering are also available.

Students at the M.S. level are expected to complete a thesis. However, with the approval of the department, a master's degree candidate in civil engineering may choose,

in lieu of submitting a thesis, to complete an additional 6 units of course work plus a special project. If this alternative is elected, candidates are expected to take comprehensive examinations over their graduate course work, and also to defend orally their special projects.

Under the Reciprocal Agreement with Neighboring Universities, a student may include as a portion of the minimum requirements work offered by the Department of Environmental Sciences and Engineering of the University of North Carolina. Although related work normally is taken in the natural sciences or mathematics, a student whose major interest relates to the social or managerial sciences may take relevant work in these areas.

**201. Advanced Mechanics of Solids.** Tensor fields and index notation. Analysis of states of stress and strain. Conservation laws and field equations. Constitutive equations for elastic, viscoelastic, and elastic-plastic solids. Formulation and solution of simple problems in elasticity, viscoelasticity, and plasticity. 3 units. *Hueckel or Petroski*

**203. Plasticity.** Inelastic behavior of soils and engineering materials; yield criteria; flow rules; concepts of perfect plasticity and plastic hardening; methods of rigid-plasticity; limit analysis; isotropic and kinematic hardening; plastic softening; diffused damage; thermo-plasticity; and visco-plasticity. Prerequisite: Civil and Environmental Engineering 201 or consent of instructor. 3 units. *Hueckel*

**204. Plates and Shells.** Differential equation and extremum formulations of linear equilibrium problems of Kirchhoffian and non-Kirchhoffian plates of isotropic and orthotropic material. Solution methods. Differential equation formulation of thin shell problems in curvilinear coordinates; membrane and bending theories; specialization for shallow shells, shells of revolution, and plates. Extremum formulation of shell problems. Solution methods. Prerequisites: Mathematics 111 and Engineering 75 or 135. 3 units. *Utku*

**205. Elasticity.** Introduction to linear theory of elasticity. Constitutive equations for anisotropic and isotropic elastic solids. Formulation and solution of torsion, bending, and flexure problems. Plane, axisymmetric, and three-dimensional problems. 3 units. *Petroski*

**207. Transport Phenomena in Biological Systems.** See C-L: Biomedical Engineering 207; also C-L: Mechanical Engineering 207. 3 units. *Bryers, Daniels, or Truskey*

**210. Intermediate Dynamics.** See C-L: Mechanical Engineering and Materials Science 210. 3 units. *Dowell*

**212. Mechanical Behavior and Fracture of Materials.** Historical perspective on structural failure. Fracture mechanics and its application to brittle and ductile fracture; fatigue in structural materials. Analysis of load spectra; fatigue crack growth calculations. 3 units. *Petroski*

**215. Engineering Systems Analysis.** Fundamental concepts and tools for engineering systems analysis, including optimization techniques and decision analysis. System definition and model formulation, optimization by calculus, linear programming, integer programming, separable integer programming, nonlinear programming, network analysis, dynamic programming, and decision analysis. Application to diverse engineering systems. 3 units. *Pas*

**216. Transportation Planning and Policy Analysis.** Issues in policy planning and decision making in urban and rural transportation systems. Transportation legislation. Public transportation alternatives with emphasis on public transit and paratransit solutions. Prerequisite or corequisite: Civil and Environmental Engineering 116 or consent of instructor. C-L: Public Policy Studies 254. 3 units. *Pas*

**217. Transportation Systems Analysis.** The transportation systems planning process. Quantitative analysis; mathematical modeling and computer simulation techniques



for short- and long-range planning and evaluation of transportation systems. Prerequisite or corequisite: Civil and Environmental Engineering 116 or consent of instructor. 3 units. *Pas*

**218. Engineering Management and Project Evaluation.** Statistical analysis and economics. Data organization, distributions, estimates of parameters, hypothesis testing, analysis of variance. Economic impact assessment, supply and demand forecasting, benefit/cost analysis, economic incentives, public and private finance, input/output analysis. 3 units. *Peirce*

**225. Dynamic Engineering Hydrology.** Dynamics of the occurrence, circulation, and distribution of water; hydrometeorology; geophysical fluid motions. Precipitation, surface runoff and stream-flow, infiltration, water losses. Hydrograph analysis, catchment characteristics, hydrologic instrumentation, and computer simulation models. Prerequisite: Civil and Environmental Engineering 122 or consent of instructor. 3 units. *Medina*

**227. Groundwater Hydrology and Contaminant Transport.** Review of surface hydrology and its interaction with groundwater. The nature of porous media, hydraulic conductivity, and permeability. General hydrodynamic equations of flow in isotropic and anisotropic media. Water quality standards and contaminant transport processes: advective-dispersive equation for solute transport in saturated porous media. Analytical and numerical methods, selected computer applications. Deterministic versus stochastic models. Applications: leachate from sanitary landfills, industrial lagoons and ponds, subsurface wastewater injection, monitoring of groundwater contamination. Conjunctive surface-subsurface models. Prerequisites: Civil and Environmental Engineering 122 and 123 or consent of instructor. 3 units. *Medina*

**233. Prestressed Concrete Design.** A critical review of research and recent developments in prestressed concrete design. Prestressed tanks, beams, and columns; partial prestressing and composite design. Prerequisite: Civil and Environmental Engineering 133. 3 units. *Biswas*

**235. Foundation Engineering.** An introduction to methods of analysis, design, and construction of foundations. Bearing capacity and settlement of shallow and deep foundations. Soil exploration, excavation and bracing, drainage and stabilization, and underpinning. Foundation vibrations. 3 units. *Hueckel*

**236. Earth Structures.** An introduction to methods of analysis, design, and construction of earth structures such as dams, embankments, cuts, canals, and airfield and highway pavements. Selection of materials, soil compaction, and stabilization. Theory of seepage, design of wells and drainage collectors. Slope stability and related problems. Theory of layered systems and pavement design procedures. 3 units. *Hueckel*

**237. Advanced Soil Mechanics.** Characterization of behavior of geomaterials; stress-strain incremental laws; nonlinear elasticity, hypo-elasticity, plasticity, and visco-elasticity of geomaterials; approximated laws of soil mechanics; fluid saturated soil behavior; cyclic behavior of soils, liquefaction and cyclic mobility; elements of soil dynamics; and thermal effects on soils. Prerequisite: Civil and Environmental Engineering 139 or equivalent. 3 units. *Hueckel*

**240. Fate of Organic Chemicals in the Environment.** Kinetic, equilibrium, and analytical approaches applied to quantitative description of processes affecting the fate of anthropogenic and natural organic compounds in ground, surface, and atmospheric waters, and in selected treatment processes. Processes discussed include sorption phenomena, gas transfer, hydrolysis, photochemistry, oxidation-reduction, and biodegradation. Techniques discussed include gas chromatography, liquid chromatography, and mass spectrometry. Spring, odd-numbered years. Prerequisite: (or corequisite) Civil and Environmental Engineering 242/Forestry and Environmental Studies 242 or equivalent. C-L: Forestry and Environmental Studies 240. 3 units. *Faust and Dubay*

**242. Environmental Chemistry.** Principles of chemical kinetics and equilibria applied to quantitative description of the chemistry of lakes, rivers, oceans, atmospheric waters, groundwaters and selected treatment processes. Equilibrium, steady state and other kinetic models applied to processes such as the carbonate system, coordination chemistry, precipitation and dissolution, oxidation-reduction, photochemistry, heterogeneous reactions, gas transfer, and some aspects of atmospheric chemistry. Spring. C-L: Forestry and Environmental Studies 242. 3 units. *Faust*

**243. Physicochemical Unit Operations in Water Treatment.** Fundamental bases for design of water and waste treatment systems, including transport, mixing, sedimentation and filtration, gas transfer, coagulation, and biotreatment processes. Prerequisite: Engineering 24 or Civil and Environmental Engineering 124. 3 units. *Bryers or Vesilind*

**244. Applied Microbial Processes.** Existing and novel biological processes used to treat or exploit waste. Concepts of microbiology, chemical engineering, and process analysis. Specific biological processes such as aerobic carbon oxidation, nitrification, denitrification, methane production, biological electricity generation, aerobic digestion, and wastewater treatment for long-term space travel. 3 units. *Bryers*

**245. Pollutant Transport Systems.** Distribution of pollutants in natural waters and the atmosphere, diffusive and advective transport phenomena within the natural environment and through artificial conduits and storage/treatment systems. Analytical and numerical prediction methods. Prerequisites: Civil and Environmental Engineering 122 and Mathematics 111 or equivalents. 3 units. *Medina*

**246. Water Supply Design.** The study of water resources and municipal water requirements including reservoirs, transmission, treatment and distribution systems; methods of collection, treatment, and disposal of municipal and industrial wastewaters. The course includes the preparation of a comprehensive engineering report encompassing all aspects of municipal water and wastewater systems. Field trips to be arranged. Prerequisite: Civil and Environmental Engineering 124 or consent of instructor. 3 units. *Vesilind*

**248. Solid Waste and Resource Recovery Engineering.** Engineering design of resource recovery systems including traditional and advanced technologies. Sanitary landfills and incineration of solid wastes. Energy recovery and recycling municipal refuse. Collection, treatment, and disposal of solid wastes from wastewater treatment. Prerequisite: Civil and Environmental Engineering 124 or consent of instructor. 3 units. *Vesilind*

**249. Control of Hazardous and Toxic Waste Engineering.** Solutions to industrial and municipal hazardous waste management problems. Handling, transportation, storage, and disposal technologies. Biological, chemical, and physical processes. Upgrading an abandoned disposal site. Economic and regulatory aspects. Case studies. Prerequisite: consent of instructor. 3 units. *Peirce*

**251. Systematic Engineering Analysis.** Mathematical formulation and numerical analysis of discrete engineering systems with emphasis on theory of structures. Equilibrium and propagation problems in continuum; properties of these systems and their discretization by the trial functions with undetermined parameters. The use of weighted residual methods, finite elements, and finite differences. Prerequisite: senior or graduate standing. 3 units. *Utku*

**254. Applications of Finite Element Analysis.** Theory of element and material models; models of metals, rock, reinforced concrete, wood, glass, soil, water, and air; analyses of torsion members, shear walls, membranes, plates, shells, solids, and compound structural systems; analysis of soil-structure and fluid-structure systems; prediction of field heating, seepage, and pollution. Prerequisite: Civil and Environmental Engineering 251 or consent of instructor. 3 units. *Melosh*

**257. Structural Optimization.** Computer-aided improvement of structural designs; redesign search processes, sensitivity analysis, integrity analysis; optimization of static, steady-state, and transient response systems; minimization of structural weight and response potentials for trusses, frames, and continua. 3 units. *Melosh*

**258. Analysis of Dynamic and Nonlinear Behavior of Structures.** Computation of nonlinear response by discretization; models for simulation of geometric, material, and boundary constraint nonlinearities; analysis of limit loads, bifurcations, and snap-through; simulation of super-elastic, plastic, viscoelastic, and slipping materials; prediction of collapsing, ballooning, gapping, metal forming, and welding behavior. Prerequisite: Civil and Environmental Engineering 251 or consent of instructor. 3 units. *Melosh*

**265. Advanced Topics in Civil and Environmental Engineering.** Opportunity for study of advanced subjects relating to programs within the civil and environmental engineering department tailored to fit the requirements of a small group. 1 to 3 units. *Graduate staff*

**281. Experimental Systems.** Formulation of experiments; Pi theorem and principles of similitude; data acquisition systems; static and dynamic measurement of displacement, force, and strain; interfacing experiments with digital computers for data storage analysis and plotting; students select, design, perform, and interpret laboratory-scale experiments in areas of fluid systems including environmental engineering, and in solid systems including structural and basic material behavior. 3 units. *J. F. Wilson*

**283. Structural Dynamics.** Formulation of dynamic models for discrete and continuous structures, normal mode analysis, deterministic and stochastic responses to shocks and environmental loading (earthquakes, winds, and waves), introduction to nonlinear dynamic systems, analysis and stability of structural components (beams and cables and large systems such as offshore towers, moored ships, and floating platforms). 3 units. *J. F. Wilson*

**301, 302. Fall and Spring Seminars.** Current topics in civil and environmental engineering theory and practice. No credit. *Director of Graduate Studies*

**399. Special Readings in Civil and Environmental Engineering.** Special individual readings in a specific area of study in civil and environmental engineering. Prerequisite: approval of Director of Graduate Studies. 1 to 3 units. *Graduate staff*

#### **COURSES CURRENTLY UNSCHEDULED**

**202. Advanced Mechanics of Solids II**

**221. Incompressible Fluid Flow**

**222. Open Channel Flow**

**223. Flow Through Porous Media**

**226. Operational Hydrology**

**231. Structural Engineering Analysis**

**232. Reinforced Concrete Design**

**234. Advanced Structural Design in Metals**

**238. Rock Mechanics**

**239. Physical Properties of Soils**

**247. Air Pollution Control**

**337. Elements of Soil Dynamics**

**350. Advanced Engineering Analysis**



## ELECTRICAL ENGINEERING

Professor Casey, *Chairman* (130 Engineering); Professor Marinos, *Director of Graduate Studies* (173 Engineering); Professors Fair, Joines, Kerr, Nolte, Pilkington, Trivedi, Wang, and T. G. Wilson; Associate Professors Dugan, Hacker, Kedem, and Massoud; Assistant Professors Alexandrou, Board, Dollas, George, Hansen, and Wong; Research Assistant Professor Frenzel; Professor Emeritus Owen

A student may specialize in any one of the following fields in working toward either the M.S. or the Ph.D. degree with a major in electrical engineering: computer-aided design, computer engineering, detection and estimation theory, digital signal processing, electromagnetic fields and microwaves, integrated circuit design and fabrication, microprocessor systems, robotics and control systems, III-V compound semiconductor devices and materials, solid-state power conditioning, and VLSI circuit design.

Recommended prerequisites for the graduate courses in electrical engineering include a knowledge of basic mathematics and physics, electric networks, and system theory. Students in doubt about their background for enrollment in specific courses should discuss the matter with the Director of Graduate Studies. The M.S. degree program includes either a thesis or a project and an oral examination. A qualifying examination is required for the Ph.D. degree program. This examination is intended to test both the breadth and depth of the student's understanding of basic electrical engineering concepts. There is no foreign language requirement.

**201. Digital Processing of Speech Signals.** Detailed treatment of the theory and application of digital speech processing. Modeling of the speech production system and speech signals, speech processing methods; digital techniques in speech transmission, speech synthesis, speech recognition, and speaker verification. Acoustic-phonetics, digital speech modeling techniques, LPC analysis methods, speech coding techniques. Application case studies: synthesis, vocoders, DTW (dynamic time warping)/HMM (hidden Markov modeling) recognition methods, speaker verification/identification. Prerequisite: Electrical Engineering 206 or equivalent or consent of instructor. 3 units. *Hansen*

**202. Digital Communication Systems.** Transmission of pulse signals over analog channels at baseband and high frequency. Effects of channel amplitude and phase distortion, multipath, and noise. Typical signaling formats and their autocorrelation functions and power spectra. Theory and design of adaptive transversal filters for the elimination of intersymbol interference. Design of digital transversal matched filters to reduce error probabilities in the presence of noise. Optimum pulse shaping techniques and Nyquist channel characteristics. Discrete Fourier transforms, FFT's, and their relation to continuous Fourier transforms. Introduction to the channel characteristics and sources of noise in optical fiber channels. Prerequisites: Electrical Engineering 186, and Mathematics 135 or Electrical Engineering 203, or consent of instructor. 3 units. *Kerr*

**203. Random Signals and Noise.** Introduction to mathematical methods of describing and analyzing random signals and noise. Review of basic probability theory; joint, conditional, and marginal distributions; random processes. Time and ensemble averages, correlation, and power spectra. Optimum linear smoothing and predicting filters. Introduction to optimum signal detection and parameter estimation. 3 units. *Kerr or Nolte*

**204. Computer Network Architecture.** The architecture of computer communication networks and the hardware and software required to implement the protocols that define the architecture. Basic communication theory, transmission technology, private and common carrier facilities. International standards. Satellite communications and local

area networks. Performance analysis and modeling of communication networks. Prerequisite: Electrical Engineering 157. C-L: Computer Science 204. 3 units. *Strole*

**205. Signal Detection and Extraction Theory.** Introduction to signal detection and information extraction theory from a statistical decision theory viewpoint. Subject areas covered within the context of a digital environment are decision theory, detection and estimation of known and random signals in noise, estimation of parameters and adaptive recursive digital filtering, and decision processes with finite memory. Applications to problems in communication theory. Prerequisite: Electrical Engineering 203 or consent of instructor. 3 units. *Nolte*

**206. Digital Signal Processing.** Introduction to the fundamentals of processing signals by digital techniques with applications to practical problems. Discrete time signals and systems, elements of the Z-transform, discrete Fourier transforms, digital filter design techniques, fast Fourier transforms, and discrete random signals. 3 units. *Nolte*

**207. Fault-Tolerant and Testable Computer Systems.** Faults and failure mechanisms, test generation techniques and diagnostic program development for detection and location of faults in digital networks; design for testability, redundancy techniques, self-checking and fail-safe networks, fault-tolerant computer architectures. Prerequisite: Electrical Engineering 157 or equivalent. C-L: Computer Science 207. Fall. 3 units. *Board or Marinos*

**208. Digital Computer Architecture and Design.** Structural organization and hardware design of digital computer systems. Arithmetic unit, switching matrices, memory organization, central processing unit (CPU), I/O unit, and microprogram control. Detailed design and simulation of a general-purpose computer system. Computer systems based on cellular structures, hardware compilers, and parallel processing architectures are also discussed. Prerequisites: Electrical Engineering 157 and Computer Science 104, or consent of instructor. C-L: Computer Science 208. Spring. 3 units. *Dollas or Marinos*

**209. Microprocessor Fundamentals and Applications.** Various state-of-the-art microprocessor chips and their associated instruction sets, microcomputer architectures, comparative study of various microprocessor designs, microprocessor-based system design illustrated by several carefully selected design projects. Prerequisites: Electrical Engineering 157 and consent of instructor. C-L: Computer Science 209. Fall. 4 units. *George*

**210. Introduction to VLSI Design.** A study of devices, circuits, fabrication technology, logic design techniques, subsystem design and system architecture. Modeling of circuits and subsystems. Testing of gates, subsystems and chips, and design for testability. The fundamentals of full-custom design, and some semi-custom design. Prerequisites: logic design (Computer Science/Electrical Engineering 157 or equivalent), and Electronics (Electrical Engineering 161, or Computer Science/Electrical Engineering 160, or equivalent). C-L: Computer Science 210. 3 units. *Dollas or Kedem*

**211. Quantum Mechanics.** Wave mechanics and elementary applications, free particle motion, Schrödinger equation, approximation methods. Fall. 3 units. *Staff*

**213. Modern Optics.** Optical processes including the propagation of light, coherence, interference, and diffraction. Consideration of the optical properties of solids with applications of these concepts to lasers and modern optical devices. 3 units. *Guenther or Hacker*

**214. Introduction to Solid-State Physics.** Discussion of solid-state phenomena including crystalline structures, thermal properties, free electron theory of metals, and band theory of semiconductors with emphasis on understanding the electrical, magnetic, and optical properties of solids. Prerequisite: Physics 161 or equivalent. C-L: Physics 214. 3 units. *Hacker*

**216. Devices for Integrated Circuits.** Basic operating concepts of the devices that are used in integrated circuits: Schottky-barriers, ohmic contacts, p-n junctions, bipolar transistors, and Si MOS capacitors and field-effect transistors. Basic MOS logic circuits. Selected laboratory work. Fall. 3 units. *Casey*

**218. Integrated Circuit Engineering.** Basic processing techniques and layout technology for integrated circuits. Photolithography, diffusion, oxidation, ion implantation, and metallization. Design, fabrication, and testing of integrated circuits. Prerequisite: Electrical Engineering 216. 4 units. *Casey or Fair*

**219. Digital Integrated Circuits.** Analysis and design of digital integrated circuits. MOSFET and bipolar devices. SPICE models. Major logic families such as NMOS, CMOS, TTL, ECL, and I<sup>2</sup>L as well as regenerative logic circuits and memories. Circuit design considerations for LSI and VLSI. Prerequisites: Electrical Engineering 157 and 216. 3 units. *Massoud*

**225. Microwave Electronic Circuits.** Microwave circuit analysis and design techniques. Properties of planar transmission lines for integrated circuits. Matrix and computer-aided methods for analysis and design of circuit components. Analysis and design of input, output, and interstage networks for microwave transistor amplifiers and oscillators. Prerequisite: Electrical Engineering 161 or equivalent. 3 units. *Joines*

**227. Network Synthesis.** Linear network theory, including a review of time and frequency domain analysis; network graphs, network functions and realizability condition; driving point impedance synthesis of passive networks; driving point and transfer specifications; approximation methods. Prerequisite: consent of instructor. 3 units. *George*

**234. Power Electronics: High-Power Circuits.** Basic principles of analysis and design of electronic power control and conversion circuits with particular emphasis on thyristor (SCRs, TRIACs) circuits. Characteristics of high-power semiconductors, commutating circuits, AC voltage controllers, AC-to-AC controlled rectifiers, DC-to-DC converters, DC-to-AC inverters, AC-to-AC converters. Laboratory. Prerequisite: Electrical Engineering 161 or equivalent. 4 units. *T. G. Wilson*

**235. Nonlinear Magnetic and Semiconductor Power Converters.** Nonlinear magnetic and semiconductor switching characteristics for transient and steady-state analysis of power electronic circuits. Design of saturable and nonsaturating magnetic devices. State-plane analysis of negative-resistance oscillators and self-oscillating inverters. Laboratory. Prerequisite: Electrical Engineering 161 or equivalent. 4 units. *T. G. Wilson*

**236. Energy-Storage Power Converters.** Analysis and design of switch-mode electronic power converters utilizing energy-storage principles. Determination of large-signal and small-signal dynamic response and stability of closed-loop regulated converters. Extensive use of computer-aided analysis, design and measurement techniques. Laboratory. Prerequisite: Electrical Engineering 161 or equivalent. 4 units. *T. G. Wilson*

**241. Linear Systems.** Modeling of multiple input-output linear systems in the frequency and time domains. Matrix differential and difference equations and their solutions; state variables. Digital simulation of differential systems. Fourier analysis of signals and systems. Transform techniques applied to state variable models. State-space models of distributed systems. 3 units. *Kerr or Wang*

**243. Advanced Linear Systems.** Linear spaces and linear operators. Impulse-response matrices. Controllability and observability. Irreducible realizations of rational transfer-function matrices. Canonical forms, state estimators, and observer theory. Stability. Linear time-invariant composite systems. Prerequisite: Electrical Engineering 241. 3 units. *Wang*

**250. Introduction to Robotics.** Fundamental notions in robotics, basic configurations of manipulator arm designs, coordinate transformations, control of robot actions, robot



programming, artificial intelligence; machine vision, force, touch, and other sensory systems; selected laboratory assignments. Prerequisites: Electrical Engineering 112 and consent of instructor. 3 units. *Wang*

**251. Pattern Classification and Recognition.** Parameter estimation and supervised learning; nonparametric techniques; linear discriminant functions; clustering; language theory related to pattern recognition; examples from areas such as character and severe weather recognition, classification of community health data, recognition of geometrical configurations, algorithms for recognizing low resolution touch-sensor array signatures and 3-D objects. Prerequisite: consent of instructor. 3 units. *Wang*

**252. Computer Systems Organization.** See C-L: Computer Science 252. 3 units. *J. Ellis or Patrick*

**253. Digital Control Systems.** For digital controllers employing algorithms not easily modeled by discrete-time difference equations (e.g., expert systems), the assumptions required by traditional design and analysis tools used in automatic control are limiting. Review of the traditional techniques used for the design of discrete-time control systems and introduce some of the "nonclassical" control problems associated with the control of intelligent machines such as robots. Prerequisite: Electrical Engineering 112. 3 units. *Myers*

**265. Advanced Topics in Electrical Engineering.** Opportunity for study of advanced subjects related to programs within the electrical engineering department tailored to fit the requirements of a small group. Prerequisites: approval of Director of Graduate Studies and instructor. 1 to 4 units. *Staff*

**271. Electromagnetic Theory.** The classical theory of Maxwell's equations; electrostatics, magnetostatics, boundary value problems including numerical solutions, currents and their interactions, and force and energy relations. Three class sessions. Prerequisite: consent of instructor. 3 units. *Hacker or Joines*

**272. Electromagnetic Communication Systems.** Review of fundamental laws of Maxwell, Gauss, Ampere, and Faraday. Elements of waveguide propagation and antenna radiation. Analysis of antenna arrays by images. Determination of gain, loss, and noise temperature parameters for terrestrial and satellite electromagnetic communication systems. Prerequisite: Electrical Engineering 164 or 271. 3 units. *Joines*

**273. Optical Communication Systems.** Mathematical methods, physical ideas, and device concepts of optoelectronics. Maxwell's equations, and definitions of energy density and power flow. Transmission and reflection of plane waves at interfaces. Optical resonators, waveguides, fibers, and detectors are also presented. Prerequisite: Electrical Engineering 143 or equivalent. 3 units. *Joines*

**308. Advanced Topics in Digital Systems.** A selection of advanced topics from the areas of digital computer architectures and fault-tolerant computer design. Prerequisite: Electrical Engineering 208 or equivalent. C-L: Computer Science 308. 3 units. *Marinos*

**310. CMOS VLSI Design.** A second course in VLSI, aimed at the design of VLSI systems in CMOS. The main thrusts of the course will be (1) to provide enough background in the theory of CMOS circuits to understand circuit level trade-offs; (2) to introduce a symbolic design system and its supporting software, which greatly aid the design process; (3) to examine sample chip designs with an eye to understanding competitive design methodologies. Students will complete a CMOS-oriented project comprising the design and implementation of either a hardware or a software subsystem. Prerequisite: Electrical Engineering 210 or equivalent. C-L: Computer Science 310. 3 units. *Kedem*

**316. Advanced Physics of Semiconductor Devices.** Semiconductor materials: band structure and carrier statistics. Advanced treatments of metal-semiconductor contacts,

Schottky barriers, p-n junctions, bipolar transistors (charge-control and Gummel-Poon models), and field-effect transistors (short channel effects, scaling theory, subthreshold conduction, nonuniformly doped substrates, surface and buried-channel devices, hot-electron effects). Device modeling in two dimensions using PISCES. Prerequisite: Electrical Engineering 216. 3 units. *Massoud and Goodwin-Johansson*

**320. Integrated Circuit Fabrication Laboratory.** Introduction to IC fabrication processes. Device layout. Mask design and technology. Wafer cleaning, etching, thermal oxidation, thermal diffusion, lithography, and metallization. Laboratory fabrication and characterization of basic IC elements (p-n junctions, resistors, MOS capacitors, gated diodes, and MOSFETs). Use of four-point probe, ellipsometer, spreading resistance probe, scanning electron microscope, and evaporation system. Testing of basic inverters and gates. Prerequisite: Electrical Engineering 218 and consent of instructor. 3 units. *Massoud*

**333. Electronic Properties of Submicron Solid-State Devices.** See C-L: Physics 333. 3 units. *Stroschio*

**399. Special Readings in Electrical Engineering.** Special individual readings in a specified area of study in electrical engineering. Prerequisite: approval of Director of Graduate Studies. 1 to 4 units. *Graduate staff*

#### COURSES CURRENTLY UNSCHEDULED

215. Semiconductor Physics

217. Lasers

222. Nonlinear Analysis

224. Advanced Electronic Circuits

226. Modeling/Computer-Aided Analysis of Electronic Systems

302. Applied Information Theory and Statistical Estimation

305. Advanced Topics in Signal Processing

317. Quantum Electronics

324. Nonlinear Oscillations in Physical Systems

342. Optimal Control Theory

371. Advanced Electromagnetic Theory

373. Selected Topics in Field Theory

#### MECHANICAL ENGINEERING AND MATERIALS SCIENCE

Professor Hochmuth, *Chairman* (142A Engineering); Professor Harman, *Director of Graduate Studies* (145 Engineering); Professors Bejan, Chaddock, Cocks, Dowell, Garg, Gösele, Pearsall, Shaughnessy, Shepard, and Tan; Associate Professors Bliss, Jones, Quinlan, and Wright; Assistant Professors Buzzard, Cherry, Georgiadis, Knight, and Needham; Associate Professor Emeritus Elsevier; Research Assistant Professor Tran-Son-Tay; Adjunct Associate Professor Wu; Adjunct Assistant Professors Hart, Jenkins, and Lind

The department offers programs of study and research leading to the M.S. and Ph.D. degrees in both mechanical engineering and materials science. Within mechanical engineering, the broad areas of concentration include thermal and fluids systems, mechanics and biomechanics, and dynamics and control. Within materials science, the areas of concentration include electronic materials, biomaterials, and the determination of material characteristics. The department emphasizes a highly research-oriented Ph.D. degree program.

Current research areas available include: cellular biomechanics; biorheology; convection; diffusion and heat transfer in heterogeneous media; aeroelasticity; computational fluid dynamics; chaotic systems; vibrations and acoustics of dynamic systems; sound propagation and absorbing materials; thermal performance of buildings; thermal design by entropy generation; control systems; robotics; expert systems; bearing design and lubrication; mechanical properties of human stones; positron annihilation spectroscopy; diffusion and kinetics in Si, GaAs, and other electronic materials; modeling and optimization of bioprocesses; and cell culture optimization.

**202. Engineering Thermodynamics.** Axiomatic formulations of the first and second laws. General thermodynamic relationships and properties of real substances. Exergy, availability, and second law analysis of energy conversion processes. Reaction and multiphase equilibrium. Power generation. Low temperature refrigeration and the third law of thermodynamics. Thermodynamic design. 3 units. *Bejan*

**205. Biochemical Engineering.** Mathematical analysis of the effects of substrate concentration, pH, temperature, and chemical inhibitors on the rate and yield of biological processes. Enzyme kinetics. Kinetics of cell growth and metabolite production in batch and continuous culture. Design of bioreactors for microbial, mammalian, and plant cell culture. Prerequisites: calculus and a course in microbial physiology or biochemistry. 3 units. *Quinlan*

**206. Optimization of Bioprocess Kinetics.** Concepts and mathematical modeling techniques needed to maximize the rates and yields at which cells produce biomass and metabolites. Prerequisite: Mechanical Engineering 205. 3 units. *Quinlan*

**207. Transport Phenomena in Biological Systems.** See C-L: Biomedical Engineering 207; also C-L: Civil and Environmental Engineering 207. 3 units. *Bryers, Daniels, or Truskey*

**208. Introduction to Colloid and Surface Science.** The colloid state: classification of colloids and the theoretical frameworks and experimental techniques involved in their characterization. Interfaces: includes surface tension and free energy; curved interfaces; adhesion, cohesion, and wetting; surface activity; catalytic and mechanical properties of solid surfaces. Inter-surface forces: the balance of attractive and repulsive forces which operate between colloidal particles and at macroscopic surfaces. Some emphasis will be placed on natural and artificial biomembranes. Prerequisite: consent of instructor. 3 units. *Needham*

**210. Intermediate Dynamics.** Comprehensive treatment of space kinematics, kinetics of particles and rigid bodies; generalized coordinates and Lagrange's equations; introduction to stability, nonlinear, and random dynamic analysis of flexible, continuous systems. C-L: Civil and Environmental Engineering 210. 3 units. *Dowell*

**211. Theoretical and Applied Polymer Science.** An advanced course in materials science and engineering, dealing specifically with the structure and properties of polymers. Particular attention is paid to recent developments in the processing and use of modern plastics and fibers. Product design is considered in terms of polymer structures, processing techniques, and properties. 3 units. *Clark or Pearsall*

**212. Electronic Materials.** An advanced course in materials science and engineering dealing with the various materials important for solid state electronics including semiconductors, ceramics, and polymers. Emphasis is placed on thermodynamic concepts and on defects in these materials. Materials preparation and modification methods for technological applications are discussed in detail. Prerequisite: Engineering 83. 3 units. *Cocks, Gösele, or Tan*

**214. Corrosion and Corrosion Control.** Effects of environments on the design and utilization of modern engineering alloys. Theory and mechanisms of corrosion, partic-



ularly in seawater and atmospheric environments. Microstructural aspects of diffusion, oxidation, hot corrosion, and stress corrosion. Prerequisite: Engineering 83. 3 units. *Cocks or Jones*

**215. Biomedical Materials and Artificial Organs.** See C-L: Biomedical Engineering 215. 3 units. *Clark*

**216. Materials Science and Solar Technology.** All aspects of materials science as related to solar energy development. Emphasis is placed on photovoltaic materials and devices, including the relationship of conversion efficiency to material properties and solar cell design. 3 units. *Cocks*

**217. Fracture of Engineering Materials.** Conventional design concepts and their relationship to the occurrence of fracture. Linear elastic and general yield fracture mechanics. Microscopic plastic deformation and crack propagation. The relationship between macroscopic and microscopic aspects of fracture. Time dependent fracture. Fracture of specific materials. Prerequisites: Engineering 83 and Mechanical Engineering 115. 3 units. *Jones*

**218. Thermodynamics of Electronic Materials.** Basic thermodynamic concepts and their application to solid state materials with emphasis on technologically relevant electronic materials such as silicon and GaAs. Thermodynamic functions, phase diagrams, solubilities and thermal equilibrium concentrations of point defects will be covered, as well as non-equilibrium processes and the kinetic phenomena of diffusion, precipitation and growth. 3 units. *Cocks, Gösele, or Tan*

**221. Compressible Fluid Flow.** Basic concepts of the flow of gases from the subsonic to the hypersonic regime. Effects of friction, heat transfer, and shock on one-dimensional inviscid flow. Potential theory, oblique shock waves, and special calculation techniques in two-dimensional flow. 3 units. *Harman or Shaughnessy*

**224. An Introduction to Turbulence.** Flow instability and the transition to turbulence. Physical characteristics of turbulent flows, averaging, and the Reynolds equation. Turbulent transport and mixing length theories. The statistical description of turbulence, correlations, and spectra. Fourier transforms. Measurement techniques. 3 units. *Shaughnessy*

**225. Mechanics of Viscous Fluids.** Equations of motion for a viscous fluid, general properties and selected solutions of the Navier-Stokes equations, the Stokes equations, laminar boundary layer equations with selected solutions and approximate techniques, origin of turbulence. 3 units. *Hochmuth*

**226. Intermediate Fluid Mechanics.** A survey of the principal concepts and equations of fluid mechanics, fluid statics, surface tension, the Eulerian and Lagrangian description, kinematics, Reynolds Transport Theorem, the differential and integral equations of motion, constitutive equations for a Newtonian fluid, the Navier-Stokes equations, and boundary conditions on velocity and stress at material interfaces. 3 units. *Shaughnessy*

**227. Advanced Fluid Mechanics.** Flow of a uniform incompressible viscous fluid. Exact solutions to the Navier-Stokes equation. Similarity methods. Irrotational flow theory and its applications. Elements of boundary layer theory. Prerequisite: Mechanical Engineering 226 or consent of instructor. 3 units. *Shaughnessy*

**228. Lubrication.** Derivation and application of the basic governing equations for lubrication; the Reynolds equation and energy equation for thin films. Analytical and computational solutions to the governing equations. Analysis and design of hydrostatic and hydrodynamic slider bearings and journal bearings. Introduction to the effects of fluid inertia and compressibility. Dynamic characteristics of a fluid film and effects of bearing design on dynamics of machinery. Prerequisites: Mathematics 111 and Mechanical Engineering 226. 3 units. *Knight*

**229. Computational Fluid Mechanics and Heat Transfer.** An exposition of numerical techniques commonly used for the solution of partial differential equations encountered in engineering physics. Finite-difference schemes (which are well-suited for fluid mechanics problems) are discussed together with the notions of accuracy, conservation, consistency, stability, and convergence. Recent applications of weighted residuals methods (Galerkin), finite-element methods, and grid generation techniques are also presented. Through specific examples, the student will be guided to construct and assess the performance of the numerical scheme selected for the particular type of transport equation (parabolic, elliptic, or hyperbolic). 3 units. *Georgiadis*

**230. Modern Control and Dynamic Systems.** Dynamic modeling of complex linear and nonlinear physical systems involving the storage and transfer of matter and energy. Unified treatment of active and passive mechanical, electrical, and fluid systems. State-space formulation of physical systems. Time and frequency-domain representation. Controllability and observability concepts. System response using analytical and computational techniques. Lyapunov method for system stability. Modification of system characteristics using feedback control and compensation. Emphasis on application of techniques to physical systems. 3 units. *Garg or Wright*

**236. Engineering Acoustics.** Fundamentals of acoustics including sound generation, propagation, reflection, absorption, and scattering. Emphasis on basic principles and analytical methods in the description of wave motion and the characterization of sound fields. Applications including topics from noise control, sound, reproduction, architectural acoustics, and aerodynamic noise. Occasional classroom or laboratory demonstration. Prerequisites: Mathematics 111 and Engineering 123 or consent of instructor. 2 units. *Bliss*

**237. Aerodynamics.** Fundamentals of aerodynamics applied to wings and bodies in subsonic and supersonic flow. Basic principles of fluid mechanics and analytical methods for aerodynamic analysis. Two- and three-dimensional wing theory, slender-body theory, lifting surface methods, vortex and wave drag. Brief introduction to vehicle design, performance, and dynamics. 3 units. *Bliss*

**240. Patent Technology and Law for Engineers.** The use of patents as a technological data base is emphasized including information retrieval in selected engineering disciplines. Fundamentals of patent law and patent office procedures. 3 units. *Cocks*

**242. Data Base Methodology.** Prerequisites: Computer Science 154 and 155. See C-L: Computer Science 241. 3 units. *C. Ellis or McHugh*

**245. Applications in Expert Systems.** A comprehensive introduction to the key practical principles, techniques, and tools being used to implement knowledge-based systems. The classic MYCIN system is studied in detail to provide historic perspective. Current systems employing combinations of production rules, prototypical knowledge, and frame-based case studies are also introduced. Student term projects consist of the development of individual, unique expert systems using the Texas Instruments Personal Consultant. Knowledge of LISP is not a prerequisite. 3 units. *Wright*

**265. Advanced Topics in Mechanical Engineering.** Opportunity for study of advanced subjects related to programs within mechanical engineering tailored to fit the requirements of a small group. Prerequisites: approval of Director of Undergraduate or Graduate Studies and instructor. 1 to 3 units. *Staff*

**270. Robot Control and Automation.** Review of kinematics and dynamics of robotic devices; mechanical considerations in design of automated systems and processes, hydraulic and pneumatic control of components and circuits; stability analysis of robots involving nonlinearities; robotic sensors and interfacing; flexible manufacturing; man-machine interaction and safety considerations. Prerequisites: Mechanical Engineering 230 or equivalent and consent of instructor. 3 units. *Garg*

**277. Optimization Methods for Mechanical Design.** Definition of optimal design. Methodology of constructing quantitative mathematical models. Nonlinear programming methods for finding "best" combination of design variables: minimizing steps, gradient methods, flexible tolerance techniques for unconstrained and constrained problems. Emphasis on computer applications and term projects. Prerequisite: consent of instructor. 3 units. *Wright*

**280. Convective Heat Transfer.** Models and equations for fluid motion, the general energy equation, and transport properties. Exact, approximate, and boundary layer solutions for laminar flow heat transfer problems. Use of the principle of similarity and analogy in the solution of turbulent flow heat transfer. Two-phase flow, nucleation, boiling, and condensation heat and mass transfer. 3 units. *Bejan*

**281. Conduction and Radiation Heat Transfer.** Conduction heat transfer in the steady and transient state; in rectangular, cylindrical, and spherical coordinates. Melting and solidification. Radiation exchange involving absorbing and emitting media including gases and flames, combined conduction and radiation, and combined convection and radiation. Exact and approximate methods of solution including separation of variables, transform calculus, numerical procedures, and integral and variational methods. 3 units. *Bejan*

**325. Aeroelasticity.** A study of the statics and dynamics of fluid/structural interaction. Topics covered include static aeroelasticity (divergence, control surface reversal), dynamic aeroelasticity (flutter, gust response), unsteady aerodynamics (subsonic, supersonic, and transonic flow), and a review of the recent literature including nonlinear effects such as chaotic oscillations. Prerequisites: Mathematics 230 and consent of instructor. 3 units. *Dowell*

**331. Nonlinear Control Systems.** Analytical, computational, and graphical techniques for solution of nonlinear systems; Krylov and Bogoliubov asymptotic method; describing function techniques for analysis and design; Liapunov functions and Lure's methods for stability analysis; Aizerman and Kalman conjectures; Popov, circle, and other frequency-domain stability criteria for analysis and synthesis. Prerequisite: Mechanical Engineering 230 or consent of instructor. 3 units. *Garg or Wright*

**399. Special Readings in Mechanical Engineering.** Individual readings in advanced study and research areas of mechanical engineering. Prerequisite: approval of Director of Graduate Studies. 1 to 3 units. *Staff*

## COURSES CURRENTLY UNSCHEDULED

**235. Advanced Mechanical Vibrations**

**322. Mechanics of Viscous Fluids**

## English

Professor Fish, *Chairman* (312 Allen); Professor Torgovnick, *Assistant Chairman*; Professor Ferguson, *Director of Graduate Studies* (316 Allen); Assistant Professor Moses, *Assistant Director of Graduate Studies*; Professors Anderson, Applewhite, Budd, DeNeef, Gleckner, Jackson, Lentricchia, Nygard, A. Patterson, L. Patterson, Price, Randall, Ryals, Sedgwick, B. H. Smith, G. Smith, Strandberg, Tompkins, G. Williams, and K. Williams; Associate Professors Butters, Clum, Gerber, Gopen, Jones, Mellow, Pope, Porter, and Schwartz; Assistant Professors Ferraro, Gaines, and Moon; Adjunct Assistant Professor Tetel

The department offers graduate work leading to the A.M. and Ph.D. degrees, although normally only students seeking the doctorate are admitted to the department.



The A.M. degree, if not already earned elsewhere, may be taken by students en route to the Ph.D. (although it is not required) and by those who elect to leave the doctoral program. A statement of the requirements for the A.M. and Ph.D. degrees may be obtained from the Director of Graduate Studies. The department requires a reading knowledge of at least one foreign language for the Ph.D. degree, the specific language (or languages) to be determined by the student's doctoral committee.

Applicants to the program in English should also furnish a copy (not returnable) of a term paper or other essay in nonfiction prose submitted in fulfillment of a requirement in an academic course.

### For Seniors and Graduates

**200. ESL Composition.** Advanced English composition and conversation for graduate students who are not native speakers of English. Selected readings in nonfiction prose. Designated special sections include forms of oral discourse. Prospective students must submit a writing sample. Credit may not be applied toward a graduate degree. Prerequisite: consent of instructor. 3 units. *Brett*

**205. Semiotics and Linguistics.** See C-L: Russian 205. 3 units. *Andrews*

**207. Old English Language and Literature.** The pre-Conquest language and representative prose and poetry. 3 units. *Nygaard*

**208. History of the English Language.** Introductory survey of the changes in sounds, forms, and vocabulary of the English language from its beginning to the present, with emphasis on the evolution of the language as a medium of literary expression. C-L: Medieval and Renaissance Studies. 3 units. *Butters, Tetel, or Nygaard*

**209. Present-Day English.** A survey of contemporary linguistic theories applied to modern English; designed for students of literature and teachers of English. 3 units. *Butters or Nygaard*

**212. Middle English Literature: 1100 to 1500.** Selected topics. C-L: Medieval and Renaissance Studies. 3 units. *Fish, Gopen, Nygaard, or L. Patterson*

**221. Renaissance Prose and Poetry: 1500 to 1660.** Selected topics. C-L: Medieval and Renaissance Studies. 3 units. *DeNeef, Fish, A. Patterson, Randall, Schwartz, or G. Williams*

**225. Renaissance Drama: 1500 to 1642.** Selected topics. C-L: Medieval and Renaissance Studies. 3 units. *A. Patterson, Randall, or G. Williams*

**235. Restoration and Eighteenth-Century Literature: 1660 to 1800.** Selected topics. 3 units. *Ferguson or Jackson*

**241. Romantic Literature: 1790 to 1830.** Selected topics. 3 units. *Applewhite, Gleckner, or Jackson*

**245. Victorian Literature: 1830 to 1900.** Selected topics. 3 units. *Ryals or Sedgwick*

**251. British Literature since 1900.** Selected topics. 3 units. *Mellown, Moses, or G. Smith*

**263. American Literature to 1865.** Selected topics. 3 units. *Anderson, Jones, Moon, or Tompkins*

**267. American Literature: 1865 to 1915.** Selected topics. 3 units. *Budd, Moon, Tompkins, or K. Williams*

**269. American Women Writers.** Selected topics. C-L: Women's Studies. 3 units. *Pope or Tompkins*

**275. American Literature since 1915.** Selected topics. 3 units. *Ferraro, Lentricchia, Moses, Pope, or Strandberg*

**281. Studies in Genre.** History, criticism, and theory of literary genres such as the novel, pastoral, epic, and drama. 3 units. *Staff*

**283. Feminist Theory and the Humanities.** C-L: Religion 269 and Women's Studies. 3 units. *Clark, Orr, Pope, Sedgwick, or Tompkins*

**285. Major Texts in the History of Literary Criticism.** A survey of major critical writings from Aristotle to the present. 3 units. *Staff*

**288. Special Topics.** Subjects, areas, or themes that cut across historical eras, several national literatures, or genres. 3 units. *Staff*

**289. The Theory of the Novel.** Major issues in the history and theory of the novel. 3 units. *Moses or Torgovnick*

#### **For Graduates**

**310. Studies in Old English Literature.** Intensive study of major Old English texts. *Nygaard*

**312. Studies in Middle English Literature.** C-L: Medieval and Renaissance Studies. 3 units. *Fish, Nygaard, or L. Patterson*

**315. Studies in Chaucer.** C-L: Medieval and Renaissance Studies. 3 units. *Fish, Nygaard, or L. Patterson*

**321. Studies in Renaissance Literature.** C-L: Medieval and Renaissance Studies and Women's Studies. 3 units. *DeNeef, Fish, A. Patterson, Randall, Schwartz, or G. Williams*

**324. Studies in Shakespeare.** C-L: Medieval and Renaissance Studies. 3 units. *A. Patterson, Porter, or G. Williams*

**329. Studies in Milton.** C-L: Medieval and Renaissance Studies. 3 units. *DeNeef, Fish, A. Patterson, or Schwartz*

**337. Studies in Augustanism.** 3 units. *Ferguson or Jackson*

**338. Studies in a Major Augustan Author.** 3 units. *Ferguson or Jackson*

**341. Studies in Romanticism.** 3 units. *Applewhite, Gleckner, or Jackson*

**347. Studies in Victorianism.** 3 units. *Ryals or Sedgwick*

**348. Studies in a Major Nineteenth-Century British Author.** 3 units. *Gleckner, Jackson, Ryals, or Sedgwick*

**353. Studies in Modern British Literature.** 3 units. *Mellown, Moses, G. Smith, or Torgovnick*

**361. Studies in American Literature before 1915.** 3 units. *Anderson, Budd, Jones, Moon, Tompkins, or K. Williams*

**368. Studies in a Major American Author before 1915.** 3 units. *Anderson, Budd, Jones, Moon, Tompkins, or K. Williams*

**375. Studies in Modern American Literature.** 3 units. *Applewhite, Ferraro, Lentricchia, Moses, or Strandberg*

**376. Studies in a Modern Author (British or American).** 3 units. *Applewhite, Ferraro, Lentricchia, Mellown, Moses, Pope, G. Smith, Strandberg, or Torgovnick*

**381. Special Topics Seminar.** 3 units. *Staff*

**385. Studies in Literary Criticism.** 3 units. *Fish, Lentricchia, Pope, Sedgwick, B. H. Smith, or Tompkins*

**386. Problems in the Theory of Value and Judgment.** See C-L: Literature 300; also C-L: Philosophy 300. 3 units. *B. H. Smith*

**388. The History of Rhetoric: Classical to Renaissance.** The foundations of rhetorical studies from Plato, Aristotle, Cicero, and Quintilian through Longinus, Augustine, and Erasmus to Bacon and Ramus. No prerequisites. 3 units. *Gopen*

**389. The History of Rhetoric: Eighteenth to Twentieth Centuries.** Continuing study of the major texts in the history of rhetoric with special attention paid to J. Q. Adams, Campbell, Blair, Whately, Bain, Perelman, and Burke. Investigation of three centuries of composition pedagogy. Prerequisite: English 388. 3 units. *Gopen*

**390. Composition Theory and Pedagogy.** Methodologies of teaching composition, with special emphasis on the theories of structural stylistics employed in the University Writing Program (UWP). The course also deals with psychological, sociological, and dramatic considerations in becoming a teacher. All students registering in the course must hold a tutorship in the UWP, must attend the UWP training seminar and all scheduled UWP staff meetings, and will be observed teaching by a UWP director. 3 units, ungraded. *Gopen*

**391. Tutorial in Special Topics.** Directed research and writing in areas unrepresented by regular course offerings. Prerequisite: consent of instructor. 3 units. *Staff*

**392. Tutorial in Journal Editing.** Systematic exposure to all phases of academic journal editing. Restricted to holders of journal editing internships. 3 units, ungraded. *Budd or Lentricchia*

**393. Professionalism, Theory, and Power in Legal and Literary Studies.** 3 units. *Fish*

## COURSES CURRENTLY UNSCHEDULED

**383. Studies in Textual Criticism**

## TUTORIALS

Tutorials in specialized subjects of study not available in the courses listed above may be offered to single students or to small groups. Instruction normally will be conducted in weekly sessions, or more frequently if the instructor wishes. Emphasis will be on independent reading and investigation, and on oral and written reports. A substantial amount of writing will be required.

Permission of the instructor and the Director of Graduate Studies is required.

## Forestry and Environmental Studies

Professor Dutrow, *Dean* (216 Biological Sciences); Professor Stambaugh, *Director of Graduate Studies* (011 Biological Sciences); Professors Christensen, Knoerr, and Richardson; Associate Professors Kramer, Reckhow, and Richter; Assistant Professors Di Giulio, Faust, Maguire, Oren, and Parks; Professors Emeriti Anderson, Hellmers, Jayne, Philpott, and Yoho; Adjunct Professors Boyce, Condrell, Dieter, Hyde, Sizemore, and Steen; Adjunct Associate Professor Healy; Adjunct Assistant Professor Alig

Major and minor work is offered in the areas of natural resource science/ecology, natural resource systems science, and natural resource economics/policy. Programs of study and research lead to the A.M., M.S., and Ph.D. degrees. College graduates who have a bachelor's degree in one of the natural or social sciences, forestry, engineering, business, or environmental science will be considered for admission to a degree program. Students will be restricted to the particular fields of specialization for which they are qualified academically. Graduate School programs usually concentrate on some area of natural resource science/ecology, systems science, or economics/policy, while study in resource



management is more commonly followed in one of the professional master's degree programs of the School of Forestry and Environmental Studies. For more complete program descriptions and information on professional training in forestry or environmental studies, the *Bulletin of Duke University: School of Forestry and Environmental Studies* should be consulted.

The specific degrees available in forestry and related natural resources through the Graduate School are: the A.M. (with or without a thesis), M.S. (with a thesis), and the Ph.D. Students majoring in forestry or environmental studies may be required to demonstrate satisfactory knowledge of one or two foreign languages for the Ph.D. degree. More information on degree and language requirements can be found in the registration and regulations section of this bulletin.

**200. Student Projects.** Prerequisite: consent of the dean of the School of Forestry and Environmental Studies. Units to be arranged. *Staff*

**201. Field Studies.** Units to be arranged. *Staff*

**204. Forest Inventory, Growth, and Yield.** Measurement of land and forests for purposes of management, appraisal, purchase, and sale. Techniques for predicting the growth and future yield of stands by various methods. Fall. 3 units. *Davison*

**205. Silviculture.** Consideration of the decision-making processes by which prescriptions are formulated for regeneration, tending, and harvesting of forest stands. Biological factors underlying stand manipulation are stressed and economic, harvesting, and utilization variables are discussed as appropriate. Emphasis on principles and techniques that transcend vegetational types or geographic regions. Spring. 4 units. *Oren*

**207. Forest Pest Management.** Fundamentals of entomology and plant pathology as appropriate to understanding the impacts of insects and diseases on forest productivity and their assessment for integration into forest management. Regional case examples and complexes are evaluated in terms of pest-population, forest-stand dynamics; economic and societal constraints; treatment strategies; monitoring systems; and benefit-cost analysis. This approach seeks to develop predictive capabilities in long-range pest management and decision making. Laboratory is largely field oriented to focus on diagnostics and impact analysis. Fall. 3 units; 4 units with laboratory. *Stambaugh*

**210L. Forest Pathology.** Diseases of North American forests and their timbers, with emphasis on current literature and management strategies. Field and laboratory diagnosis. Offered on demand. 3 units; 4 units with laboratory. *Stambaugh*

**211L. Applied Ecology and Ecosystem Management.** An application of ecological principles to applied resource and environmental problems with an emphasis on the ecosystem as a basic working unit. Perspectives include such topics as land/water interactions, the patchiness concept, succession, energy flow, productivity, mineral cycling, perturbation effects on ecosystems, and limiting factors. Laboratory studies will focus on the team approach to analyzing the biotic and abiotic components of the ecosystem and impact analysis. Fall. 4 units. *Richardson*

**212. Ecological Toxicology.** Study of environmental contaminants from a broad perspective encompassing biochemical, ecological, and toxicological principles and methodologies. Discussion of sources, environmental transport and transformation phenomena, accumulation in biota and ecosystems. Impacts at various levels of organization, particularly biochemical and physiological effects. Fall. Prerequisites: organic chemistry and vertebrate physiology or consent of instructor. 3 units. *Di Giulio*

**213. Forest Ecosystems.** Introduction to basic processes regulating ecosystem development, structure and function; examination of ecosystem concepts and the effects of management activities on ecosystem processes and patterns. Elective laboratory, taught

as Forestry and Environmental Studies 266, introduces field aspects of forest ecology. Spring. 3 units. *Richter*

**215. Environmental Physiology.** Examination of the concepts of tolerance, limiting factors, bioenergetics, nutrition, stress physiology, homeostasis, and alleopathy for both plant and animal life. Discussion of procedures for and examples of monitoring physiological perturbations due to resource manipulation. Spring, even-numbered years. 3 units. *Di Giulio and Oren*

**216. Applied Population Ecology.** Discussion of population dynamics of natural and exploited populations. A quantitative approach with an emphasis on mathematical models and their application to population problems. Spring, odd-numbered years. 3 units. *Maguire*

**218. Barrier Island Ecology.** Adaptation of plants to barrier island migration and other physical characteristics of the coastal environment. Major emphasis will be placed on management of barrier beaches from Maine to Texas and the impact of human interference with natural processes. Field studies. Prerequisite: a course in general ecology. Given at Beaufort. C-L: Botany 218 and Marine Sciences 218. 6 units. *Evans, Peterson, and Wells*

**221. Soil Resources.** Introduction to soil resources and the interactions of forest production, management, and soil fertility. Topics include soil chemistry, physics, development, and nutrient cycling, all from the perspective of maintaining and improving forest productivity. Fall. 3 units. *Richter*

**230. Weather and Climate.** Overview of the science of meteorology and principles of climatology, especially as applied to problems in ecology and natural resource management. Emphasis on the processes and characteristics of weather phenomena and local and regional climates. General introduction to sources of climatic data and climatic data analysis. Fall. 4 units. *Knoerr*

**231. Environmental Climatology.** Applications of climatology to solving problems in ecology and natural resource management. History of the atmosphere and world climates is considered to provide a perspective on current conditions. Impact of weather on human behavior, property and natural resource management. Spring, on demand. 3 units. *Staff*

**232. Microclimatology.** Introduction to the microclimatological processes. Discussion of the integration of these processes and the resulting microclimates in the rural (forest, field, and water surface) and urban environments. Methods for modification of the microclimate. C-L: Botany 232. Spring, on demand. 3 units. *Knoerr*

**234. Watershed Hydrology.** Introduction to the hydrologic cycle with emphasis on the influence of land use, vegetation, soil types, climate, and land forms on water quantity and quality and methods for control. Development of water balance models. Analysis of precipitation patterns, rainfall and runoff, and nonpoint source impacts. Statistical handling and preparation of hydrologic data, simulation and prediction models, introduction to groundwater flow, laboratory and field sampling methods. Fall. 4 units. *Staff*

**236. Water Quality Management.** Types, sources, and effects of pollutants. Water quality standards and criteria. Engineering approaches to water management. Mathematical models and their application to water quality management. Federal regulations, in particular, the Federal Water Pollution Control Act amendments of 1972 and 1977. Economic and policy analysis for water quality management planning. Fall. 3 units. *Reckhow*

**237. Watershed Modeling and Management.** Analysis of models for individual hydrologic processes. Evaluation of management-oriented watershed models based on the hydrologic process models. Simulations with watershed models as a basis for manage-

ment decision making to optimize water yield quantity, timing, or quality under various vegetative, climatic, topographic, and soil conditions. Prerequisite: Forestry and Environmental Studies 234. Spring. 3 units. *Knoerr*

**240. Fate of Organic Chemicals in the Environment.** Kinetic, equilibrium, and analytical approaches applied to quantitative description of processes affecting the fate of anthropogenic and natural organic compounds in ground, surface, and atmospheric waters, and in selected treatment processes. Processes include sorption phenomena, gas transfer, hydrolysis, photochemistry, oxidation-reduction, and biodegradation. Techniques discussed include gas chromatography, liquid chromatography, and mass spectrometry. Spring, odd-numbered years. Prerequisite: (or corequisite) Civil and Environmental Engineering 242/Forestry and Environmental Studies 242 or equivalent. C-L: Civil and Environmental Engineering 240. 3 units. *Dubay and Faust*

**242. Environmental Chemistry.** Principles of chemical kinetics and equilibria applied to quantitative description of the chemistry of lakes, rivers, oceans, atmospheric waters, groundwaters, and selected treatment processes. Equilibrium, steady state, and other kinetic models applied to processes such as the carbonate system, coordination chemistry, precipitation and dissolution, oxidation-reduction, photochemistry, heterogeneous reactions, gas transfer, and some aspects of atmospheric chemistry. Spring. C-L: Civil and Environmental Engineering 242. 3 units. *Faust*

**261. Remote Sensing for Resource Management.** An examination of remote sensing systems as sources of information in resource management with an emphasis on aerial photography and multispectral scanners. Emphasis on the interpretation of airborne and space imagery. Spring. 3 units. *Davison*

**262. Forest Utilization.** Introduction to utilization in the managed forest and the principal wood-using industries. Taught as a one-week field seminar. May be taken by non-forestry majors. Spring. 1 unit, intensive. *Staff*

**266. Ecology of Southern Appalachian Forests.** One-week introduction to forest ecosystems in the southern Appalachians, including species identification, major forest types, patterns in ecosystem distributions, and effects of human activities. 1 unit, intensive. *Richter*

**267. Wildland and Wildlife Management.** Overview of topics in wildlife and habitat management, each focusing on biological, economic, legal, and sociopolitical constraints; action variables and points of influence; and institutional contexts at the local, national, and international levels. Lectures, guest speakers, and student presentations. Fall, on demand. 3 units. *Boyce and Maguire*

**270. Resource Economics and Policy.** The application of economic concepts to private and public sector decision making concerning natural and environmental resources. Investment analysis, benefit-cost analysis. Planning and policy concepts. Prerequisite: introductory course in economics. C-L: Public Policy Studies 272. Spring. 4 units. *Kramer*

**283. Environmental Policy and Values.** Discussion of varying philosophical approaches to the allocation and use of natural resources and the environment. Views espoused by ecologists, preservationists, naturalists, conservationists, economists, planners, theologians, lawyers, and political scientists are considered. Through extensive readings, students consider who values what in society, and who gets what, when, and how. Prerequisite: consent of instructor. Fall. 3 units. *Staff*

**285. Land Use Principles and Policies.** Consideration of four major roles of land in the United States: as a producer of commodities, financial asset, component of environmental systems, and location of development. Analysis of market allocation of land, market failure, role of public planning and regulation. 3 units. Fall. *Healy*



**299. Independent Projects.** Directed readings or research at the graduate level to meet the needs of individual students. Units to be arranged. *Staff*

**301. Forest Nutrition Management.** Basic processes of soil chemistry and ecosystem nutrient cycling as regulators of forest production. Management impacts such as fertilization, fire, harvest, and biological nitrogen fixation. Laboratories include methods of determining site fertility, assessing forest productivity, and using computer simulation models to guide management decisions in forest nutrition programs. Spring. 4 units. *Staff*

**302. Models in Forestry.** Students learn how to design and choose models for forestry and ecology. Emphasis on using models to develop strategy and evaluate policy for culturing forests and related ecosystems. Subjects include timber, wildlife, water, recreation, and cash flow. Fall. 3 units. *Boyce*

**306. Dynamic Modeling of Forest Management Strategies.** Simulation of the financial aspects of silvicultural practices when used to produce timber, wildlife habitat, water, range and recreational benefits; economics of production; and trade-offs for multiple benefits. Students use actual forest inventories to devise silvicultural strategies, which are simulated with the system dynamics models DYNAST and STELLA on microcomputers. Fall. 1 unit, intensive. *Boyce and Easterling*

**307. Forest Stress.** Exploration of principles governing stand growth and its responses to a variety of stresses. Emphasis on climate, soil resources, and competition. Stresses and their reliefs as modifiers of either the availability of resources or the physiological properties of trees. Fall. 3 units. *Oren*

**312. Wetlands Ecology.** The study of bogs, fens, marshes, and swamps. Emphasis on processes within the ecosystem: biogeochemical cycling, decomposition, hydrology, and primary productivity. Ecosystem structure, the response of these systems to perturbations, and management strategies are discussed. A research project is required. Prerequisites: Forestry and Environmental Studies 211 or equivalent and consent of instructor. Spring, odd-numbered years. 3 units. *Richardson*

**313. Advanced Topics in Ecotoxicology.** Discussion of current issues. Topics vary but may include chemical carcinogenesis in aquatic animals; biomarkers for exposure and sublethal stress in plants and animals; techniques for ecological hazard assessments; and means of determining population, community, and ecosystem level effects. Lectures and discussions led by instructor, guest speakers, and students. Spring, odd-numbered years. Prerequisite: Forestry and Environmental Studies 212. *Di Giulio*

**314. Integrated Case Studies in Toxicology.** See C-L: Pharmacology 314. 4 units. *Abou-Donia and staff*

**316. Case Studies in Environmental Management.** Introduces an integrated ecological, economic, and sociopolitical approach to solving resource management problems. Students work in groups to analyze local problems and present their results. Emphasis on setting goals for research, project organization, selection of quantitative tools, preparation of written and oral presentations. Prerequisites: Forestry and Environmental Studies 211 and 251 or equivalents. Spring. 4 units. *Staff*

**322. Microbiology of Forest Soils.** Ecology of the microbial populations of forest soils, with emphasis on rhizosphere interactions, root pathogenesis, and mycorrhizae. Prerequisite: consent of instructor; mycology and bacteriology are recommended. Spring, odd-numbered years. 4 units, offered on demand. *Stambaugh*

**330L. Environmental Monitoring and Instrumentation.** Methods of measuring and monitoring the earth's physical environment with emphasis on water and air resources. Characteristics and uses of contemporary sensors, measurement and data acquisition systems. Methods of obtaining and processing computer compatible data records. Includes laboratory. C-L: Botany 330L. Spring, on demand. 4 units. *Knoerr*

**331. Water Resource Systems.** Introduction to the fundamentals of water resource systems planning and management. Emphasis on optimization, simulation, statistical and economic principles for management of surface and subsurface water resources. Topics include project selection and evaluation, design of standards and regulations, stochastic and deterministic quantity/quality simulation models, water supply and wastewater treatment technologies, decision and risk analysis. Spring. 3 units. *Staff*

**332. Air Quality Management and Modeling.** Types and sources of atmospheric contaminants including effects of industry, urban development, farming and forestry practices, and recreation. Meteorological effects on air quality. Determination of air quality trends and the application of management systems from a meteorological point of view. Types and applications of air quality models. Performance of air quality models under various emission sources, meteorological, and topographic conditions. Fall, on demand. 3 units. *Staff*

**335. Water Quality Modeling.** Development and evaluation of simulation models of surface water quality. Mechanistic description of aquatic ecosystems and materials transport. Parameter estimation, methods of solution, including uncertainty analysis. Prerequisites: Forestry and Environmental Studies 234, 236, 350, 355. Fall, odd-numbered years. 2 units. *Reckhow*

**350. Applied Regression Analysis.** Regression analysis with nonexperimental data using ordinary least squares. Emphasis on assumption violations: consequences and correctives. Analysis of variance and time series analysis using Box-Jenkins methods as time permits. Prerequisite: Forestry and Environmental Studies 251 or equivalent. Spring. 4 units. *Reckhow*

**355. Optimization Methods for Resource Management.** Introductory survey of optimization techniques useful in resource management and environmental decision making. Numerical techniques for unconstrained optimization, linear programming, dynamic programming, and optimal control methods. Prerequisite: consent of instructor. Fall. 3 units. *Staff*

**357. Systems Ecology and Modeling.** Concepts of systems analysis and simulation modeling in ecology. Examples emphasize use of systems analysis and modeling to solve environmental management problems. Prerequisites: ecology, introductory statistics, computer programming on microcomputer and TUCC; additional quantitative background desirable. Spring, even-numbered years. 3 units. *Maguire*

**361. Forest Resource Management.** The integration of biological, socioeconomic, and environmental constraints in planning, organizing, and managing forest properties for maximizing production of timber and other benefits. Emphasis on analysis of growth and yield for regulation of growing stock; application of economic imperatives in decision making, including valuation of forest land and related resources; and use of microcomputers in simulating management options. Prerequisites: Forestry and Environmental Studies 204, 205, 270, and 302. Spring. 4 units. *Parks*

**366. Mathematical Modeling of Lake and Reservoir Water Quality.** Practical application of mathematical models of lake and reservoir water quality. The major objective is to expose the participant to a wide variety of techniques that are useful in predicting the responses of lakes and impoundments to pollutants. Statistical and mass balance models are included. Knowledge of elementary calculus and statistics is recommended. Fall. 1 unit, intensive. *Chapra and Reckhow*

**367. Seminar in Forest Resource Management.** Examination of concepts, practices, and policies employed in the management of industrial and public forests; discussion of the problems of large-scale forest management. Offered since 1985-86 as the Laird Norton Distinguished Visitor Series. Spring. 1 unit. *MacKinnon*

**372, 373. Advanced Natural Resource Economics.** Survey of advanced topics in natural resource and environmental economics. Emphasis on renewable resources and public policy. Prerequisite: consent of instructor. Fall and spring. 3 units each. *Staff*

**376. USDA Forest Service Inventory Data: Content and Use.** Introduction to means of applying inventory data to particular problems. Fall. 1 unit, intensive. *Boyce*

**381. Natural Resource Policy.** An examination of institutions and processes in the public sector that influence natural resource allocation and use of the environment. Emphasis on political allocation of resources, especially legislative and administrative processes. Topics include the rules of democracy and free enterprise, lobbying, public participation, planning, and advocacy. Prerequisite: consent of instructor. Spring. 3 units. *Staff*

**382. International Environmental Problems.** Global and transboundary issues; management of international disputes. Environmental consequences of Third World development, including industrial pollution, rural land degradation, deforestation, misuse of chemicals, protection of biodiversity. Comparative analysis of policies. Spring. 3 units. *Healy*

**385. Decision Theory and Risk Analysis.** Bayesian decision theory, including conditional probability, subjective probability, utility theory, value of sample information, and multiattribute problems. Behavioral decision theory. Applications of decision theory in resource and environmental policy-making. Prerequisite: Forestry and Environmental Studies 251 or equivalent. Spring, even-numbered years. 3 units. *Maguire and Reckhow*

**388. Seminar in Resource and Environmental Policy.** Discussion of the political, legal, and socioeconomic aspects of public and private action in environmental quality control and management. Prerequisite: consent of instructor. Fall, spring. 1 unit. *Staff*

**389. Seminar in Forest and Conservation History.** Evolution of resource agencies, forest industries and associations, and conservation/environmental organizations. Public policies for land and resources are compared with priorities and constraints in the private sector. Prerequisite: consent of instructor. Spring, odd-numbered years. 2 units. *Steen*

#### **COURSES CURRENTLY UNSCHEDULED**

**208. Fire Behavior and Use**

**209. Forest Entomology**

**305. Harvesting Effects on Productivity**

**308. Tree Biology**

**309. Forest Regeneration**

**310. Forest Productivity and Mineral Cycling**

**318. Seminar in Ecotoxicology**

**338. Micrometeorology and Biometeorology Seminar**

**384. Special Tax Problems for Industrial Timberland Owners**

### **The University Program in Genetics**

Professors Amos (microbiology and immunology), Antonovics (botany), Bastia (microbiology and immunology), Boynton (botany), Counce (cell biology), Gillham (zoology), Gross (biochemistry), Holmes (medicine and biochemistry), Joklik (microbiology and



immunology), Kredich (biochemistry), Modrich (biochemistry), Moses (cell biology), Nevins (microbiology), Nicklas (zoology), Ruderman (zoology), C. Ward (zoology), F. Ward (microbiology and immunology), and Webster (biochemistry); Associate Professors Endow (microbiology and immunology), Greene (biochemistry), Greenleaf (biochemistry), M. Hershfield (biochemistry), Hsieh (biochemistry), Keene (microbiology and immunology), Laurie (zoology), Linney (microbiology and immunology), Rausher (zoology), Steege (biochemistry), and Uyenoyama (zoology); Assistant Professors Burdett (microbiology and immunology), Johnston (botany), Kaufman (biochemistry), Kohorn (botany), Kreuzer (microbiology and immunology), Ostrowski (microbiology and immunology), Pickup (microbiology), Schachat (cell biology), and Swain (microbiology); Adjunct Professors Drake (National Institute of Environmental Health Sciences), Judd (National Institute of Environmental Health Sciences), Kunkel (National Institute of Environmental Health Sciences), Lucchesi (University of North Carolina), Resnick (National Institute of Environmental Health Sciences), and Sugino (National Institute of Environmental Health Sciences)

The University Program in Genetics provides a coherent course of study in all facets of biology related to genetics. This is an interdisciplinary program with a faculty drawn from several of the biological science departments (cell biology, biochemistry, botany, microbiology and immunology, and zoology). Graduate students registered in any of the biological sciences departments may apply to the faculty of the genetics program to pursue study and research leading to an advanced degree. It would be helpful if applicants for admission to the Graduate School indicated their interest in the genetics program at the time of application. Requests for information describing more completely the research interests of the staff, facilities, and special stipends and fellowships should be addressed to the Director, Genetics Program (Department of Biochemistry).

**215. Genetic Mechanisms.** Prerequisite: introductory biochemistry. See C-L: Biochemistry 215. 3 units. *Webster and staff*

**268. Molecular Biology II: Nucleic Acids.** See C-L: Biochemistry 268; also C-L: Cell Biology 268, Microbiology and Immunology 268, and The University Program in Cell and Molecular Biology. 4 units. *Modrich and staff*

**280. Principles of Genetics.** See C-L: Botany 280; also C-L: Zoology 280. 3 units. *Antonovics, Boynton, Gillham, and Laurie*

**281. DNA, Chromosomes, and Evolution.** Prerequisites: an introductory course in genetics or cell or molecular biology, or consent of instructor. See C-L: Zoology 281. 3 units. *Laurie and Nicklas*

**283. Extrachromosomal Inheritance.** See C-L: Zoology 283; also C-L: Botany 283. 3 units. *Boynton (botany) and Gillham*

**285S. Ecological Genetics.** Prerequisites: Biology 180 and Botany 286 or equivalents. See C-L: Botany 285S. 3 units. *Antonovics*

**286. Evolutionary Mechanisms.** See C-L: Botany 286; also C-L: Zoology 286. 3 units. *Antonovics (botany), Uyenoyama, and H. Wilbur*

**288. Mathematical Population Genetics.** See C-L: Zoology 288. 3 units. *Uyenoyama*

**336. Contemporary Topics in Immunogenetics.** See C-L: Microbiology and Immunology 336. 2 units. *Amos and Ward*

**Genetics Colloquium.** Lectures, discussion sections, and seminars on selected topics of current interest in genetics. Required of all students specializing in genetics. Prerequisites: a course in genetics and consent of instructor. 1 unit. *Antonovics and staff*

# Geology

Professor Perkins, *Chairman* (204 Old Chemistry); Professor Heron, *Director of Graduate Studies* (205 Old Chemistry); Professors Pilkey and Rosendahl; Associate Professors Baker, Corliss, Johnson, and Karson; Assistant Professors Boudreau, Klein, and Strelitz

The Department of Geology offers graduate work leading to the M.S. and Ph.D. degrees. An undergraduate degree in geology is not a prerequisite for graduate studies, but a student must have had or must take a summer field geology course (or equivalent experience), mineralogy, igneous and metamorphic rocks, stratigraphy or sedimentation, and structural geology. In addition, the student must have had one year of college chemistry, one year of college physics, and mathematics through calculus.

Graduate courses and research in the Department of Geology provide specialized training in the fields of facies analysis, sedimentary petrology, geological oceanography and limnology, coastal geology, micropaleontology, paleoceanography, geophysics, low-temperature geochemistry, igneous petrology, high-temperature geochemistry, and structural geology and tectonics. An acceptable thesis is required. There is no language requirement for the M.S. degree.

## For Seniors and Graduates

**200. Beach and Coastal Processes.** The study of sedimentary processes, and geomorphology of nearshore environments with emphasis on both developed and undeveloped barrier island systems. 3 units. *Pilkey*

**203. Physical Oceanography.** Physical processes in the oceans: the physical properties of seawater, the dynamics of currents, waves and tides, and the transmission of light and sound in the sea. Prerequisite: Physics 41 or 51. (Given at Duke Marine Lab, Beaufort.) C-L: Marine Sciences 203. 2 units. *Johnson*

**206S. Principles of Geological Oceanography.** Geological aspects of the ocean basins including coastal to deep water sediment types and sedimentation processes, sea floor physiography and environmental problems. 3 units. *Pilkey*

**208S. Paleoceanography.** Geology, paleoceanography, and evolution of the oceans, ocean basins, and marine biota based on analysis of deep-sea sedimentary sequences. 3 units. *Corliss*

**209S. Marine Sediments.** Sedimentary processes in nearshore, shelf, and deep-sea environments. Emphasis on field methods and laboratory analyses. (Given at Beaufort.) C-L: Marine Sciences 209S. 4 units. *Johnson*

**212. Carbonate Facies Analysis: Recent and Ancient.** Origin, distribution, and diagenetic alteration of recent carbonate sediments and their ancient analogs. Prerequisite: Geology 111. 3 units. *Perkins*

**214S. Sedimentary Petrography.** Descriptive and interpretive analysis of sediments and sedimentary rocks in thin section, with an emphasis on diagenesis. Prerequisite: consent of instructor. 3 units. *Perkins*

**215. Clastics Facies Analysis: Recent and Ancient.** Modern clastic depositional systems and their ancient analogs. Prerequisite: Geology 111. 3 units. *Heron*

**216. Field Analysis of South Florida Carbonates.** Analysis of recent sediments and organisms and their Pleistocene analogs. One-week field trip. Prerequisite: Geology 111 or consent of instructor. 1 unit. *Perkins*

**219. Sediment Transport.** How river, ocean, and wind currents move solid particles. Dimensional analysis, near-bed turbulence, boundary layer forces, initiation and rates of particle movement, bed-load vs. suspended-load, erosion, deposition, sorting,

evolution and motion of dunes and other bed forms. Emphasis on physical understanding of phenomena with application to environmental issues (for example, dust generation, desertification), engineering questions (for example, silting of channels) and geological problems (for example, ripple laminae, size-sorting). Prerequisite: Civil and Environmental Engineering 122 or consent of instructor. 3 units. *Haff*

**230S. Advanced Structural Geology.** In depth treatment of stress and strain for geologists emphasizing geometric, kinematic, and dynamic analysis of microstructures and mesoscopic structures. Prerequisite: Geology 130 or consent of instructor. 3 units. *Karson*

**233. Oceanic Crust and Ophiolites.** Structure, tectonics, petrology, and geochemistry of oceanic spreading environments and ophiolite complexes. Prerequisites: Geology 106 and 130 or consent of instructors. 3 units. *Karson*

**236. Lithosphere Plate Boundaries.** Plate tectonics and the geological and geophysical expression of orogenic belts, spreading centers, transform faults, subduction zones. Prerequisite: Geology 130 or consent of instructors. 3 units. *Karson and Rosendahl*

**237S. Structure and Evolution of the Appalachian Orogen.** Overview of sedimentation, deformation, and metamorphism responsible for the development of the Appalachian Mountain Belt from Newfoundland to Alabama in the context of plate tectonics. Prerequisites: Geology 106, 108, and 130 or consent of instructor. 3 units. *Karson*

**239S. Advanced Topics in Structural Geology and Tectonics.** Selected topics related to deformation of rocks ranging from microstructure to plate tectonics. Prerequisites: Geology 130 and 230 or consent of instructor. 3 units. *Karson*

**249. Marine Micropaleontology.** Introduction to marine microfossils, basic principles of micropaleontology and stable isotope geochemistry with applications to paleoceanography. Lectures and laboratory. 3 units. *Corliss*

**251. Physics of the Earth.** Origin, primeval evolution, rotation, potential fields, paleomagnetism, gravity anomalies, earthquake seismology, thermal properties, internal structure of the earth, and thermodynamics of plate motions. Prerequisites: Geology 41 and Chemistry 12 and Mathematics 32 and Physics 52 or consent of instructor. 3 units. *Strelitz*

**252. Exploration Seismology.** Elastic wave theory, reflection and refraction of acoustic waves, field methodologies, computer processing, and interpretation of seismic data. Prerequisites: Geology 41 and Mathematics 32 and Computer Science 51 and Physics 52 or consent of instructor. 3 units. *Rosendahl*

**255. Seismic Interpretation.** Basic rock physics, seismic expression of structural styles, seismic facies analysis, maps generated from seismic data, and basin-wide seismic stratigraphic analysis. Prerequisite: Geology 251; corequisite: Geology 252 or consent of instructor. 3 units. *Rosendahl and Staff*

**260S. Hydrocarbon Exploration.** Origin, migration, and accumulation of hydrocarbons with emphasis on exploration techniques. Prerequisites: Geology 111 and 251. 3 units. *Perkins and Rosendahl*

**270. Sedimentary Geochemistry.** Chemistry of aqueous solutions and authigenic minerals in sedimentary systems. Prerequisites: Chemistry 12 and Mathematics 32. 3 units. *Baker*

**271. Isotope Geochemistry.** Theory and applications of stable and radioactive isotope distributions in nature. Prerequisites: Chemistry 12 and Mathematics 32. 3 units. *Baker*

**272. Biogeochemistry.** Processes controlling the circulation of carbon and biochemical elements in natural ecosystems and at the global level, with emphasis on soil and sur-



ficial processes. Prerequisite: Chemistry 12 or equivalent. C-L: Botany 272. 3 units. *Schlesinger*

**275. Economic Geology.** Geology and geochemistry of ore deposits. Prerequisite: consent of instructor. 3 units. *Baker*

**281S. Advanced Topics in Igneous Petrology.** Current topics in igneous petrology including andesite petrogenesis, ocean ridge basalts, and experimental petrology. Prerequisites: Geology 105 and 106. 3 units. *Staff*

**283S. Experimental Methods in Geology.** Theory and application of experimental techniques in igneous and metamorphic petrology and high- and low-temperature geochemistry, with examples from recent literature. Prerequisites: Geology 105 and 106 or consent of instructor. 3 units. *Staff*

**292. Computer Methods in Geology.** Techniques used in the geological sciences including simulation and forward modeling, inverse and least squares methods, statistical methods and exploratory data analysis as well as graphics. Prerequisites: Mathematics 32 and Computer Science 51, or consent of instructor. 3 units. *Strelitz*

**295S. Advanced Topics in Geology.** Topics, instructors, and credits to be arranged each semester. C-L: Marine Sciences 295S. *Staff*

### For Graduates

**371, 372. Advanced Topics in Geology.** To meet the individual needs of graduate students for independent study in various environmental sedimentary fields. 1 to 3 units. *Staff*

### COURSES CURRENTLY UNSCHEDULED

**217. Field Analysis of Ancient Sedimentary Sequences**

**253S. Geophysics**

## Germanic Languages and Literature

Associate Professor Borchardt, *Chairman*; Professor Rolleston, *Director of Graduate Studies* (102 Languages); Associate Professor Alt; Assistant Professors Morton and Rasmussen

The Department of Germanic Languages and Literature offers graduate work leading to the A.M. degree. Students who expect to major in German should have had sufficient undergraduate courses in Germanic languages to enable them to proceed to more advanced work.

Students who wish to take courses in German as a related field should normally have completed a third-year course (in exceptional cases, a second year) of college German with acceptable grades.

### For Seniors and Graduates

**200S. Proseminar.** Fundamental course for advanced study of German; literary history, schools of criticism, practical exercises in interpretation, and research methods. 3 units. *Alt*

**201S, 202S. Goethe.** His life and works, in the light of his lasting significance to German and world literature. 201S: lyrics, prose, fiction, and selected dramas. 202S: *Faust I and II*. 3 units each. *Morton*

**205, 206. Middle High German.** The language and literature of Germany's first classical period. C-L: Medieval and Renaissance Studies. 3 units each. *Rasmussen*

**207S. German Romanticism.** The principal writers of the period from 1795 to 1830. 3 units. *Alt or Rolleston*

**209S. Drama.** Studies in the German-speaking theater with emphasis on the nineteenth century. 3 units. *Alt*

**210S. The Eighteenth Century.** The culture of reason, progress, and the individual in early modern philosophy and literature. Leibniz, Lessing, Herder, Kant, Schiller. 3 units. *Morton*

**211S. Nineteenth-Century Literature.** From the end of romanticism through realism. 3 units. *Alt*

**214S. The Twentieth Century.** Literature of the twentieth century presented through representative authors. 3 units. *Rolleston*

**215S. Seventeenth-Century Literature.** Leading writers of the baroque, viewed against the background of their time. C-L: Medieval and Renaissance Studies. 3 units. *Borchardt*

**216. History of the German Language.** Development of the phonology, morphology, and syntax of German from the beginnings to the present. C-L: Medieval and Renaissance Studies. 3 units. *Rasmussen*

**217S. Renaissance and Reformation Literature.** The period from 1400 to about 1600. C-L: Medieval and Renaissance Studies. 3 units. *Borchardt*

**218S. The Teaching of German.** A survey of modern teaching techniques: problems in the teaching of German on the secondary and college levels. Analysis and valuation of textbooks, related audiovisual material, and computer programs. 3 units. *Alt*

**219. Applied Linguistics.** The application of modern linguistic principles to a systematic study of the phonetics, morphology, and syntax of modern German. Prerequisite: consent of instructor. 3 units. *Rasmussen*

**230S. Lyric Poetry.** Studies in poetry and poetic theory. From Goethe and the romantics to Rilke, Benn, and contemporary authors. 3 units. *Rolleston*

## COURSES CURRENTLY UNSCHEDULED

321, 322. Germanic Seminar

## Health Administration

Professor McMahan, *Chairman*; Associate Professor Taylor, *Director of Graduate Studies*; Professors Jaeger and Warren; Associate Professors Falcone and Roth; Assistant Professor Smith; Adjunct Associate Professors Donelan, Winfree, and Yaggy; Adjunct Assistant Professors Magruder-Habib and Moore

The Department of Health Administration offers graduate work leading to the M.H.A. degree. The graduate program is offered through two academic years and leads principally toward a career in the corporate management of hospitals and other health services organizations. Most of the required first year courses are taken in the Fuqua School of Business and second year electives are also available there. A ten-week administrative internship at an approved health care institution or agency is required between the first and second year. Students without previous administrative experience in the health field are encouraged to apply for a twelve-month administrative fellowship following graduation. Admission to the program is based upon the capability for graduate study and demonstrated leadership potential of the candidate.

**301. Health System and the Environment.** Introduction to the organizational and professional systems which provide health care services, including past, present, and future perspectives and relationships among institutions, professionals, government, and the private sector. Emphasis is on the changing and dynamic nature of the health care environment and resulting system responses. 3 units. *Staff*

**302. Organizational Behavior in Health Systems.** This course will consider the leadership roles of the manager and his or her responsibility for maintaining a productive organization in a changing economic environment. It will develop models for considering consequences of the interaction of members of the organization with changing technology and other externalities, and will examine how appropriate leadership behavior frequently determines the success or failure of an institution. 3 units. *Taylor*

**303-304. Health Systems and the Environment Laboratory.** A laboratory course to facilitate familiarity with the operation of health facilities and the appreciation of the challenge of planning, organizing, financing, staffing, controlling, and evaluating the provision of health care services. (To be taken concurrently with Health Administration 301 and 302.) 1 unit each. *McMahon*

**311-312. Leadership Seminar.** Designed as the integrating course of the program, this two-semester seminar provides a forum for ongoing interaction among student/faculty/practitioners in the context of exploring the concepts and implementation of strategies for both causing and responding to the dynamics of change in health organizations. 1 unit each. *McMahon*

**321-322. Strategic Management.** A comprehensive, two-semester course which applies and extends courses taken in the Fuqua School and draws upon several disciplinary areas in order to develop a conceptual and operational basis for management control over designing, planning, allocating, utilizing, and evaluating resources used in providing health services. 3 units each. *Warren, Jaeger, and Roth*

**325. Health Law for Management.** Introduction to law and the legal approach to problem solving in health care; provides background for understanding the role of law and legal institutions in affecting access, availability, cost, quality, and evaluation of health care services. 3 units. *Warren*

**327. Financial Management for Health Care Organizations.** Provides a comprehensive overview of both short-run and long-term issues in health care financial management. Topics include cash management, collection and disbursement techniques, cash forecasting, short-run financial planning, receivables management, capital budgeting under uncertainty, dividend policy, and capital structure decisions. 3 units. *Taylor*

**331. Human Resources Management.** Course focuses on the responsibilities and role of all managers and supervisors in regard to human resource management, the issues in developing a proactive human resource planning model with an adaptable framework, and strategies for responding to events, trends, and issues affecting human resources. 3 units. *Taylor*

**341, 342. Advanced Seminar in Health Care Institutional Management.** An integrating sequence of case studies in institutional and programmatic settings designed to provide students the opportunity to study actual problems and to propose solutions in the classroom setting. 3 units each. *Jaeger*

**343. Comparative Health Systems.** Against the backdrop of the United States health system, including the Veterans Administration system, the course examines the potential for innovation and common problems in health services delivery from an international perspective. 3 units. *Falcone*

**352. Health Services for the Aged.** Covers socioeconomic, cultural, and demographic trends affecting health and medical care for older persons; political and legal developments; health care facilities and alternatives to institutionalization; geriatrics and gerontology for the administrator. 3 units. *Falcone*

**354. Quality Assurance, Risk Management, and Liability Insurance.** A seminar to acquaint students with the theory and concepts of coordinated quality assurance and risk



management in health care organizations. Attention is given to the steps involved in designing and implementing an effective QA/RM program and various insurance mechanisms. 3 units. *Moore and Warren*

**356. Health Policy Analysis.** The major purpose is to broaden and enrich students' perspectives on the health system through an examination of policy determinants, with a focus on political system variables, structures, and processes, against the backdrop of environmental constraints. 3 units. *Falcone*

**357. Current Legal Issues in Health Administration.** A seminar which covers current regulatory, legislative, and judicial matters which affect the administration of health services. Emphasis is on identifying governmental developments, such as new Medicare or OSHA regulations, and analyzing their potential impact on the field, as well as surveying possible legal and administrative responses. Both current hospital literature and legal materials, including the Federal Register, are used in class participation. 3 units. *McMahon and Warren*

**358. Cost-Benefit Analysis.** Demonstrates the utility of logical modes in management and planning decisions. Since this logic is usually quantifiable within limits, the course reviews problem conceptualization, methodology, and techniques for determining the costs, benefits, effectiveness, and efficacy of decisions regarding optimal deployment of resources. 3 units. *Falcone*

**362. Managed Care.** This course is designed to examine the current state of development of alternative delivery systems (health maintenance organizations, preferred provider organizations, competitive medical plans and other mechanisms to control costs by changing provider incentives) and to explore likely future directions such systems will take. 3 units. *Jaeger*

**371, 372. Directed Research.** Individual studies and health services projects by arrangement. 3 units each. *Staff*

## History

Professor Warren Lerner, *Chairman* (235 Allen); Associate Professor Wood, *Director of Graduate Studies* (233A Allen); Professors Cahow, Cell, Chafe, C. Davis, Durden, Gaspar, Kuniholm, Mauskopf, Miller, Oates, Richards, Roland, A. Scott, W. Scott, TePaske, Witt, and Young; Associate Professors R. Davis, Dirlik, English, Gavins, Goodwyn, Gordon, Herrup, Keyssar, Koonz, Nathans, Neuschel, and Reddy; Assistant Professors Ewald, Green, Robisheaux, and J. Scott; Professors Emeriti Colton, Ferguson, Franklin, Holley, Parker, Preston, Ropp, and Watson

The Department of History offers graduate work leading to the A.M. and Ph.D. degrees. Candidates for the A.M. degree must have a reading knowledge of at least one ancient or modern foreign language related to their programs of study and have completed successfully a substantial research paper, or two seminar papers, normally the product of a year's seminar or two semester courses. The paper(s) must be approved by two readers, the supervising professor and a second professor from the graduate staff. Students anticipating a May degree must have their papers read and approved by April 15; those anticipating a September degree must have their papers read and approved by August 1.

Candidates for the degree of Doctor of Philosophy prepare themselves for examinations in four fields, at least three of which shall be in history. The choice of fields is determined in consultation with the student's supervisor and the Director of Graduate Studies. The department offers graduate instruction in the broad areas of North America; Latin America; Great Britain and the Commonwealth; ancient, medieval, and Renaissance Europe; modern Europe; Russia; Japan; China; South Asia; military; history of science, technology, and medicine; and in the comparative and thematic fields of women's history,

environmental history, diplomatic history, labor history, and slave societies. The candidate for the Ph.D. degree must have a reading knowledge of two foreign languages to be picked in conjunction with the candidate's supervisor. In certain cases, an alternative to the second language may be chosen if approved by both the candidate's supervisor and the Director of Graduate Studies. Such an alternative must take the form of successful completion of a course or courses which would appreciably increase the candidate's methodological proficiency; such as a graduate course in statistics, archaeology, demography, numismatics, cartography, or a summer training program for developing methodological skills. A course or courses in a discipline outside history—anthropology, literature, sociology, political science, ecology, geography, etc.—will not necessarily qualify as an alternative to a second language. Also, the alternative must be in addition to any previous undergraduate work in the methodology. Whether satisfied by two languages or by one language and an alternative, the requirement must be met prior to the preliminary examination.

**Ancient History.** For courses in ancient history which may be taken for credit in either history or classical studies, see Classical Studies.

### For Seniors and Graduates

Students may receive credit for either semester of a hyphenated course at the 200 level without taking the other semester if they obtain written consent from the instructor.

**201S. The Russian Intelligentsia and the Origins of the Revolution.** Origin and dynamics of the Russian revolutionary movement, the intelligentsia, and the emergence of the labor movement. 3 units. *Miller*

**202S. The Russian Revolution.** An analysis of the Bolshevik seizure of power in 1917 and the establishment of a revolutionary society and state during the 1920s. 3 units. *Miller*

**207, 208. Constitutional History of Britain: The Rise of the Common Law.** The origins and development of Britain's law and constitution, related to its setting in a changing society. C-L: (for 207) Medieval and Renaissance Studies. 3 units each. *Herrup*

**215-216. The Diplomatic History of the United States.** (Not open to undergraduates who have had History 121, 122.) 6 units. *C. Davis*

**217S, 218S. Western Europe in the Twentieth Century.** Topics in political and social history: Europe in 1900; the impact of two world wars; the social politics of the great depression; fascism and nazism; economic recovery and changes after 1945. 3 units each. *Staff*

**219S, 220S. History of Science and Technology.** The interaction of science and technology in the Western world from earliest times to the present. 3 units each. *Mauskopf and Roland*

**221. Topics in the Social and Economic History of Europe, 1200-1700.** C-L: Medieval and Renaissance Studies. 3 units. *Staff*

**222. Problems in the Intellectual History of the European Renaissance and Reformation.** Prerequisites: History 194 and reading knowledge of German, French, or Italian. C-L: Medieval and Renaissance Studies. 3 units. *Witt*

**225S. Problems in Comparative Labor History.** Common dilemmas and varying solutions in the cross-national development of labor-management relations, their political implications, and their larger historical significance. 3 units. *Gordon, Keyssar, or Reddy*

**226. Topics in the Labor History of the United States.** 3 units. *Keyssar*

**227-228. Recent United States History: Major Political and Social Movements.** C-L: Women's Studies. 6 units. *Chafe*

**231S, 232S. Problems in the History of Spain and the Spanish Empire.** 3 units each. *TePaske*

**233. Slave Resistance and Social Control in New World Societies.** The operation of slave societies in the Americas from the sixteenth to the nineteenth centuries focusing on master-slave relations and slave resistance. 3 units. *Gaspar*

**234S. Political Economy of Development: Theories of Change in the Third World.** See C-L: Political Science 234S; also C-L: Cultural Anthropology 234S and Sociology 234S. 3 units. *Fox, Gereffi, Smith, and Valenzuela*

**235S. The Antebellum South.** The economic, political, and social aspects of life in the South, 1820-1860. 3 units. *Nathans*

**237S. Europe in the Early Middle Ages.** C-L: Medieval and Renaissance Studies. 3 units. *Young*

**238S. Europe in the High Middle Ages.** C-L: Medieval and Renaissance Studies. 3 units. *Young*

**239S. History of Socialism and Communism.** Problems in the origins and development of socialist and communist movements. 3 units. *Lerner*

**241-242. United States Constitutional History.** 241: to 1865; 242: 1865 to the present. 6 units. *Cahow*

**243-244. Marxism and History.** Critical examination of Marxist theory and its relevance to historical understanding and explanation. 6 units. *Dirlik*

**245, 246. Social and Intellectual History of China.** 3 units each. *R. Davis and Dirlik*

**247. History of Modern India and Pakistan, 1707-1857.** Analysis and interpretation, with special emphasis on social and economic change. 3 units. *Richards*

**248. History of Modern India and Pakistan, 1857 to the Present.** 3 units. *Richards*

**249-250. Social and Intellectual History of the United States.** The interplay of ideas and social practice through the examination of attitudes and institutions in such fields as science and technology, law, learning, and religion. 6 units. *Holley*

**253S, 254S. European Diplomatic History, 1871-1945.** Origins of the First and Second World Wars, the diplomacy of the wars, and the peace settlements which followed them. 3 units each. *W. Scott*

**260. Fifth and Fourth Century Greece.** See C-L: Classical Studies 222. 3 units. *Oates or Rigsby*

**261. Alexander and the Hellenistic World.** See C-L: Classical Studies 223. *Oates*

**262. Problems in Soviet History.** Studies in the background of the Revolution of 1917 and the history and politics of the Soviet state. 3 units. *Lerner*

**263. The Roman Republic.** See C-L: Classical Studies 224. 3 units. *Boatwright or Rigsby*

**264. The Roman Empire.** See C-L: Classical Studies 225. 3 units. *Boatwright*

**265S. Problems in Modern Latin American History.** 3 units. *Staff*

**267S. England in the Sixteenth Century.** C-L: Medieval and Renaissance Studies. 3 units. *Herrup*



**268S. England in the Seventeenth Century.** C-L: Medieval and Renaissance Studies. 3 units. *Herrup*

**269S-270S. British History, Seventeenth Century to the Present.** Historiography of social structure and social change: English Revolution, party, the Industrial Revolution, class and class consciousness, Victorianism, and the impact of war in the twentieth century. 6 units. *Cell*

**273S, 274S. Topics in the History of Science.** Critical stages in the evolution of scientific thought. 3 units each. *Mauskopf*

**277S. The Coming of the Civil War in the United States, 1820-1861.** 3 units. *Durden*

**278S. The Civil War in the United States and Its Aftermath, 1861-1900.** 3 units. *Durden*

**279, 280. Health, Healing, and History.** The development of medicine within the broader cultural context from prehistory to the twentieth century. Not open to students who have had History 181, 182. 3 units each. *English*

**282S. Canada.** Topics vary each semester and may include nationalism in Canada, Canadian defense policies, Canadian-American relations, regionalism in Canada, environmental issues, and others. C-L: Cultural Anthropology 282S, Political Science 282S, and Sociology 282S. 3 units. *Cahow*

**284S. Feminist Theory and the Social Sciences.** Examination of feminist modes of inquiry in the social sciences. The relationship of gender in economic, political, social, and cultural systems and the resulting shifts in social science disciplines. C-L: Cultural Anthropology 284S, Political Science 264S, Psychology 284S, Sociology 284S, and Women's Studies. 3 units. *Chafe, Neuschel, O'Rand, C. Smith, or Spenner*

**285S, 286S. Oral History.** Research on race relations and civil rights in the United States in the twentieth century using techniques of oral history. 3 units each. *Chafe and Goodwyn*

### Required Courses for Graduates

**301-302. Research Seminar in History.** Either this seminar or History 307-308 is required of all entering first-year doctoral candidates in history. 6 units. *Staff*

**307-308. Seminar in United States History.** Either this seminar or History 301-302 is required of all entering first-year doctoral candidates in history. 6 units. *Staff*

**312. Seminar in the Teaching of History in College.** The work in this course is intended to acquaint students with the problems involved in teaching history in college. Required of all candidates for the degree of Doctor of Philosophy who are in residence for two years at Duke. As an alternate method of meeting this requirement, a graduate student may, in cooperation with a member of the faculty, serve a one-semester teaching apprenticeship. No credit. Supervised by Director of Graduate Studies.

**314. Historical and Social Science Methodology.** Methods used in historical research with emphasis upon the various social science approaches. 3 units. *Neuschel*

History 314 is required of all candidates for the Ph.D. degree who are in residence for two years at Duke University.

### Colloquia and Seminars for Graduates

**351-352. Colloquia.** Each colloquium deals with an aspect of history by means of readings, oral and written reports, and discussion, with attention to bibliography. Ad hoc colloquia may be worked out during registration in the various fields represented by members of the graduate faculty; these colloquia do not appear on the official schedule of courses. In some instances, students may take the equivalent of a research seminar in con-

junction with the colloquium and will be credited with an additional 6 units by registering for 371.1-372.1, etc. C-L: Women's Studies.

**371-372. Research Seminars.** To be taken either in conjunction with colloquia listed above or by special arrangement with appropriate graduate instructors when research seminars in a desired area are not offered. These seminars do not appear on the official schedule of courses. 6 units. *Staff*

### **Independent Study**

**399. Special Readings.** Supervised independent study and reading. Prerequisite: consent of professor. 3 units.

**N.B.** For the most current listing of scheduled courses, please refer to the most recent Duke University official schedule of courses printed twice a year.

### **COURSES CURRENTLY UNSCHEDULED**

**212. The American Indian in the Revolutionary Era, 1760-1800**

**229S, 230S. Revolution in Modern Europe, 1789-1919**

**259. Archaic Greece**

**266. Late Antiquity**

## **The Master of Arts Program in Humanities**

Professor Charles R. Young, *Director* (history)

The Master of Arts Program in Humanities is an interdepartmental program and is tailored to the needs of individual students. The candidate defines a theme and selects appropriate course work with the aid and approval of a supervising committee. Thirty units of course work and proficiency in a foreign language are required for completion of the program. The degree may be earned with or without a thesis. The candidate who chooses not to submit a thesis will submit instead at least two substantial papers arising from course work for review by committee members, and meets with them to discuss his or her program in a final master's colloquium.

The program is open to holders of undergraduate degrees in any discipline who can demonstrate sufficient background in humanities to permit study at the graduate level. Admission is by regular application to the Graduate School. Students may enroll full time or part time (minimum of 3 units per term). Students considering entering the program may enroll in an appropriate graduate course or courses through the Office of Continuing Education, at the same time making their interest known to the Director of the Humanities Program.

## **The Master of Arts in Liberal Studies Program**

Diane Sasson, Ph.D., *Director*

This interdisciplinary program allows individuals with a variety of professional and personal educational interests the flexibility to pursue their goals across disciplinary boundaries. The program is managed by an interdepartmental committee which admits students, selects courses, and determines policy. Students study primarily on a part-time basis and choose from an array of interdisciplinary courses developed specifically for this program. In addition to the special liberal studies courses, students may select courses from other departments in the Graduate School.

The MALS program consists of nine courses and a final project. These courses are offered during three academic terms (fall, spring, and summer) and may be taken either full-time or part-time. For more information on specific courses and other program re-

quirements, a separate bulletin on the Master of Arts in Liberal Studies may be requested from the program director (120 Allen Building, Duke University, Durham, North Carolina 27706).

## The Ph.D. Program in Literature

Professor Jameson, *Chairman* (Graduate Program in Literature and French); Professor A. Patterson, *Director of Graduate Studies* (Graduate Program in Literature and English); Professors DeNeef (English), Dorfman (Graduate Program in Literature and Latin American Studies), Fish (English and Law), Lentricchia (English and Graduate Program in Literature), Mudimbe (French and Graduate Program in Literature), Pérez Firmat (Spanish and Graduate Program in Literature), Radway (Graduate Program in Literature), Rolleston (Germanic languages and literature), B. H. Smith (Graduate Program in Literature and English), Stewart (French), Thomas (French), and Tompkins (English)

The interdepartmental program leading to a Ph.D. in literature offers to qualified students the opportunity to develop individual courses of study with a strong emphasis on interdisciplinary work, literary theory, and cultural studies, while at the same time building strength in one or more of the national literatures. The program offers both introductory courses (the 250 series) and more specialized seminars (the 280 series), as well as tutorials (300) in specific research projects or problems.

For tutorials, advising, and dissertation supervision the program draws also on the expertise of other faculty such as Associate Professor Wharton (art); Professor Newton and Associate Professor Burian (classical studies); Professors Ryals and L. Patterson (English); Professor Tetel and Associate Professors Orr and Kaplan (French); Professor Borhardt (German); Assistant Professor Roderick (philosophy).

Students entering the program must present evidence of ability to read one language other than English, and must acquire reading competence in a second language before taking their preliminary examinations.

More information on the program and a full descriptive brochure is available from Professor Patterson, Director of Graduate Studies, 305 Carr Building, Duke University, Durham, North Carolina 27706.

**251. History of Criticism.** A historical survey of critical and philosophical concepts affecting the definition and evaluation of literature from Plato and Aristotle through the nineteenth century. 3 units. *DeNeef, Lentricchia, or Pérez Firmat*

**252. Criticism and Literary Theory in the Twentieth Century.** Introduction to critical movements, philosophies, and strategies forming contemporary theories of literature: deconstruction, feminism, formalism, Marxism, New Criticism, phenomenology, psychoanalysis, structuralism. May be repeated for credit according to change of content or instructor. 3 units. *Jameson or Rolleston, with guest lecturers*

**253. Philology, Linguistics, and the Roots of Literature.** A survey of the various ways in which language and literature interact, with an introduction to philology and historical linguistics. 3 units. *Thomas*

*(The 280-290 series implies prior knowledge of literary theory, past and present; these courses are open to graduate students and qualified seniors only.)*

**280. Semiotics for Literature.** See C-L: French 223. 3 units. *Thomas*

**281. Paradigms of Modern Thought.** Specialized study of the work of individual thinkers who have modified our conceptions of human reality and social and cultural history, with special emphasis on the form and linguistic structures of their texts considered as "language experiments." Topics will vary from year to year, including: Marx and Freud; J.-P. Sartre; Walter Benjamin; etc. 3 units. *Jameson*



**282. Contemporary Literary Theory.** Specialized studies in literary theory from Saussurean linguistics to the present day (e.g., deconstruction, feminism, new historicism, neopragmatism, reception theory). 3 units. *Fish, Jameson, Lentricchia, Patterson, or Tompkins*

**283. Modernism.** Aspects of the "modern," sometimes with emphasis on the formal analysis of specific literary and nonliterary texts (Joyce, Kafka, Mahler, Eisenstein); sometimes with a focus on theories of modernism (Adorno), or on the modernism/postmodernism debate, or on the sociological and technological dimensions of the modern in its relations to modernization, etc. 3 units. *Jameson or Lentricchia*

**284. The Intellectual as Writer.** History and theory of the literary role of the intellectual in society (e.g., in Augustan Rome, the late middle ages, the Renaissance, America, Latin America). 3 units. *Jameson, Lentricchia, Mudimbe, or Patterson*

**285. Literature and Ideology.** The theoretical problem of the relationship between literature and ideology, explored through the cultural history of genres, major writers, or aesthetic movements. 3 units. *Jameson, Lentricchia, Mudimbe, or Patterson*

**286. Topics in Legal Theory.** A consideration of those points at which literary and legal theory intersect (e.g., matters of intention, the sources of authority, the emergence of professional obligation). 3 units. *Fish*

**287. Problems in Narrative Analysis.** An introduction to contemporary theories and methods of narrative analysis (Greimas, Barthes, Hayden White, etc.), with emphasis on a specific area, e.g., historiography, film, sub-genres of the novel, myth, cognitive discourse. 3 units. *Jameson, Mudimbe, or Radway*

**288. Basic Issues in the History of Literary Theory.** Issues include attempts to define literature, divergent views of its social functions and psychological effects, and contemporary controversies regarding literary meaning and interpretation. Readings range from classic texts in philosophy of art to contemporary essays in critical theory. 3 units. *B. H. Smith*

**289. Topics in Feminist Theory.** 3 units. *Radway or Tompkins*

**290. Topics in Psychoanalytic Criticism.** 3 units. *Staff*

**291. Topics in Popular Culture and the Media.** 3 units. *Radway or Tompkins*

**292. Topics in Non-Western Literature and Culture.** 3 units. *Mudimbe or Pérez Firmat*

**300. Problems in the Theory of Value and Judgment.** An advanced seminar dealing with classic problems relating to the concept of value and evaluative behavior (e.g., standards, judgments, canon-formation, taste), as illuminated by contemporary work in critical theory, anthropology, economics, sociology, etc. C-L: English 386 and Philosophy 300. 3 units. *B. H. Smith*

## The University Program in Marine Sciences

Professor Ramus (botany) *Acting Director*; Professors Costlow\* (zoology), Forward (zoology), Gutknecht (cell biology), McClay† (zoology), Osmond (botany), Pilkey‡ (geology), and Searles‡ (botany); Associate Professors C. Bonaventura (cell biology), J. Bonaventura (cell biology), Johnson (geology), Sullivan (biochemistry), and Sutherland (zoology); Assistant Professor Rittschof (zoology); Professor Emeritus Bookhout (zoology)

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\*On sabbatical leave 1 January-31 December 1989.

†Summer only.

‡Spring only.

Graduate students from any and all academic disciplines are encouraged to take professional training at the Marine Laboratory. The program operates year-round, providing course work in the marine sciences, an active seminar program, and facilities supporting dissertation research. Resident graduate students represent the Departments of Biochemistry, Botany, Cell Biology, Forestry and Environmental Studies, Geology, and Zoology. Ordinarily, dissertation advisers are resident as well, although this need not be the case. The Marine Laboratory has available several graduate student instructional assistantships and fellowships during the academic year, including summer. In addition, tuition credits obtained from fellowship support may be applied to courses given both at the Marine Laboratory and the Durham campus.

Persons interested in graduate work in marine sciences should apply through one of the appropriate departments. Forms may be obtained from the Graduate School.

Applications for graduate or undergraduate courses and for graduate graded research during the summer at the laboratory should be addressed to the Admissions Office, Duke University Marine Laboratory, Beaufort, North Carolina 28516. Additional information and the application form are included in the *Bulletin of Duke University: Marine Laboratory*. The application for enrollment in summer courses at the laboratory should be accompanied by transcripts of undergraduate and graduate work. Applications should be received as early as possible. Graduate students planning to enroll in courses or seminars offered during the fall or spring at the Marine Laboratory should notify the Admissions Office of the Marine Laboratory of such intent *prior* to the beginning of the respective semester. Students registering for graded research in the fall, spring, or summer should do so under the appropriate departmental numbers.

The following courses are offered at Beaufort. See the *Bulletin of Duke University: Marine Laboratory* for the current schedule of courses.

## FALL, SPRING, OR SUMMER PROGRAM AT BEAUFORT

### For Juniors, Seniors, and Graduates

**203. Physical Oceanography.** Physical processes in the oceans: the physical properties of seawater, the dynamics of currents, waves and tides, and the transmission of light and sound in the sea. Prerequisite: Physics 41 or 51. C-L: Geology 203. 2 units. *Johnson*

**203L. Marine Ecology.** Application of ecological theory to marine systems. Emphasis on hypothesis formulation, field experimentation, data analysis, scientific writing, and familiarity with current ecological literature. Prerequisite: course in introductory ecology, invertebrate zoology, or marine botany (phycology); knowledge of statistics helpful. C-L: Zoology 203L. 6 units. *Hay (visiting summer faculty)*

**209S. Marine Sediments.** Sedimentary processes in nearshore, shelf, and deep-sea environments. Emphasis on field methods and laboratory analyses. C-L: Geology 209S. 4 units. *Johnson*

**209, 210. Independent Study.** A tutorial designed for students who are interested in either a laboratory or a library project in biochemistry. C-L: Biochemistry 209, 210. Credit to be arranged. *Staff*

**210. Individual Study.** Directed reading and research in cell biology/physiology. Prerequisite: consent of Director of Graduate Studies. C-L: Cell Biology 210. Credit to be arranged. *Staff*

**213L. Behavioral Ecology.** How ecological factors shape foraging, mating, aggressive, and social behavior. Laboratory experiments and field observations from the Outer Banks environment. Independent projects and seminars. Prerequisite: introductory biology. C-L: Zoology 213L. 4 units. *Rubenstein (visiting summer faculty)*

**217L. Biology of Marine Macrophytes.** Physiology and ecology of seaweeds, seagrasses, marshgrasses, and mangroves. Biological flux of carbon and nutrients in coastal

seas. Ecological consequences of photosynthetic adaptations. Prerequisites: introductory biology and chemistry. C-L: Botany 217L. 4 units. *Ramus and Osmond*

**218. Barrier Island Ecology.** Adaptation of plants to barrier island migration and other physical characteristics of the coastal environment. Major emphasis will be placed on management of barrier beaches from Maine to Texas and the impact of human interference with natural processes. Field studies. Prerequisite: course in general ecology. C-L: Botany 218 and Forestry and Environmental Studies 218. 6 units. *Evans, Peterson, and Wells (visiting summer faculty)*

**219L. Benthic Marine Algae.** Morphology, reproduction, life histories, systematics, and natural history of seaweeds. Lectures, laboratories, and fieldwork in ocean and estuaries. Prerequisite: introductory biology; plant diversity recommended. C-L: Botany 219L. 4 units. *Schneider (visiting summer faculty)*

**250L. Physiology of Marine Animals.** Environmental factors, biological rhythms, and behavioral adaptations in the comparative physiology of marine animals. Prerequisites: introductory biology and chemistry. C-L: Zoology 250L. 4 units. *Forward*

**263L. Tropical Seaweeds.** Collection, preservation, description, illustration, and descriptive ecology. Two-week field study. Prerequisite: Biology 140L or equivalent or consent of instructor. C-L: Botany 263L. 2 units. *Searles*

**266S. Seminar.** C-L: Biochemistry 266S. 2 units or variable. *Staff*

**274L. Marine Invertebrate Zoology.** Structures, functions, and habits of invertebrate animals under natural and experimental conditions. Field trips included. Prerequisite: introductory biology. Not open to students who have taken Zoology 76L or 176L. C-L: Zoology 274L. 6 units. *Ruppert (visiting summer faculty)*

**278L. Invertebrate Developmental Biology.** Gametogenesis, fertilization, and development of invertebrates, with emphasis on experimental studies of prelarval stages. Prerequisite: consent of instructor. C-L: Zoology 278L. 6 units. *McClay and visiting staff*

**295S. Advanced Topics in Geology: Continental Margin Sedimentation.** Sediment composition and distribution on the continental margin, with emphasis on North Carolina barrier island/lagoon, shelf and slope environments. The course includes fieldwork and laboratory analyses of sediments as well as readings and discussion of the current literature. Prerequisite: Geology 206S or consent of instructor. C-L: Geology 295S. 4 units. *Johnson and Wells*

**353, 354. Research.** To be carried on under the direction of the appropriate staff members. (For graduate students only.) Hours and credit to be arranged. C-L: Zoology 353, 354. *Staff*

**359, 360. Research.** Individual investigation in the various fields of botany. C-L: Botany 359, 360. Credit to be arranged. *All members of the Graduate School staff*

**371, 372. Advanced Topics in Geology.** To meet the individual needs of graduate students for independent study in various environmental sedimentary fields. 1 to 3 units. *Staff*

**Seminar.** Special topics in the marine sciences. Exploration at the advanced level of current research in the marine sciences. Subject dependent on faculty and student interests. C-L: Biochemistry 265S, 266S; Botany 295S, 296S; and Zoology 295S, 296S. 2 units. *Staff*

## COURSES CURRENTLY UNSCHEDULED

**245L. Macromolecules, Ecology, and Evolution.** (C-L: Biochemistry 245L.)

**247L. Plant Ecology.** (C-L: Botany 247L.)



## Mathematics

Professor Reed, *Chairman* (215 Physics); Professor Beale, *Director of Graduate Studies* (124B Physics); Professors Allard, Bryant, Griffiths, Schaeffer, Shoenfield, Warner, and Weisfeld; Associate Professors Burdick, Hodel, Kitchen, Kraines, Lawler, Moore, Morrison, Pardon, Saper, Scoville, Smith, Stern, and Venakides; Assistant Professors Cheney, Gardner, Layton, Nance, Papanicolaou, and Schoen; Adjunct Professor Chandra; Visiting Professor Persson; Visiting Associate Professors Bonilla and Pittie

Graduate work in the Department of Mathematics is offered leading to the A.M. and Ph.D. degrees. Admission to these programs is based on the applicant's undergraduate academic record, level of preparation for graduate study, the Graduate Record Examination, and letters of recommendation.

All A.M. and Ph.D. candidates are required to pass a qualifying examination after completing their first year of graduate study. The A.M. degree with a major in mathematics is awarded upon completion of 30 units of graded course work and passing the qualifying examination. A thesis may be substituted for 6 units of course work only under special circumstances.

Soon after the student who is pursuing a Ph.D. degree passes the qualifying examination, the Director of Graduate Studies appoints a committee of two graduate faculty members who determine the conditions to be met by the student before he or she takes the preliminary examination. Normally, this committee forms the nucleus of the student's advisory committee. The conditions may include a reading knowledge of one or more foreign languages appropriate to the student's intended area of specialization, an appropriate level of computer programming proficiency, or specific course work.

Candidacy for the Ph.D. is established by passing an oral preliminary examination. The preliminary examination is normally taken at the beginning of the third year. The preliminary examination is conducted by a committee selected by the rules of the Graduate School and the department. The examination can, at the student's option, consist of questions based either on the student's course work at Duke or on the specific area of research plus a minor subject selected by the student.

After admission to candidacy, the Ph.D. degree is awarded on the basis of the student's scholarly ability as demonstrated by the dissertation and its defense. The dissertation is the most important requirement in the award of the Ph.D. degree.

### For Seniors and Graduates

**200. Introduction to Algebraic Structures I.** Laws of composition, groups, rings; isomorphism theorems; axiomatic treatment of natural numbers; polynomial rings; division and Euclidean algorithms. Not open to students who have had Mathematics 121. Prerequisite: Mathematics 104 or equivalent. 3 units. *Staff*

**201. Introduction to Algebraic Structures II.** Vector spaces, matrices and linear transformations, fields, extensions of fields, construction of real numbers. Prerequisite: Mathematics 200, or Mathematics 121 and consent of instructor. 3 units. *Staff*

**203. Basic Analysis I.** Topology of  $R^n$ , continuous functions, uniform convergence, compactness, infinite series, theory of differentiation, and integration. Not open to students who have had Mathematics 139. Prerequisite: Mathematics 104. 3 units. *Staff*

**204. Basic Analysis II.** Inverse and implicit function theorems, differential forms, integrals on surfaces, Stokes' theorem. Not open to students who have had Mathematics 140. Prerequisite: Mathematics 203. 3 units. *Staff*

**205. Topology.** Elementary topology, surfaces, covering spaces, Euler characteristic, fundamental group, homology theory, exact sequences. Prerequisite: Mathematics 104. 3 units. *Staff*

**206. Differential Geometry.** Geometry of curves and surfaces, the Serret-Frenet frame of a space curve, the Gauss curvature, Codazzi-Mainardi equations, the Gauss-Bonnet formula. Prerequisite: Mathematics 104. 3 units. *Staff*

**221. Numerical Analysis.** Prerequisites: knowledge of an algorithmic programming language, intermediate calculus including some differential equations, and Mathematics 104. See C-L: Computer Science 221. 3 units. *Gardner, Greenside, or Szlyd*

**222. Numerical Differential Equations.** Prerequisite: Computer Science 221. See C-L: Computer Science 222. 3 units. *Gardner, Greenside, Rose, or Szlyd*

**223. Numerical Linear Algebra.** Prerequisite: Computer Science 221 or equivalent. See C-L: Computer Science 223. 3 units. *Gardner, Greenside, Rose, or Szlyd*

**230. Mathematical Methods in Physics and Engineering I.** Heat and wave equations, initial and boundary value problems, Fourier series, Fourier transforms, potential theory. Not open to students who have had Mathematics 114. Prerequisites: Mathematics 103 and 104 or equivalents. 3 units. *Staff*

**231. Mathematical Methods in Physics and Engineering II.** Green's functions, partial differential equations in several space dimensions. Complex variables, analytic functions, Cauchy's theorem, residues, contour integrals. Other topics may include method of characteristics, perturbation theory, calculus of variations, or stability of equilibria. Prerequisite: Mathematics 114 or Mathematics 230. 3 units. *Staff*

**233. Asymptotic and Perturbation Methods.** Asymptotic solution of linear and non-linear ordinary and partial differential equations. Asymptotic evaluation of integrals. Singular perturbation. Boundary layer theory. Multiple scale analysis. Prerequisite: Mathematics 114 or equivalent. 3 units. *Staff*

**234. Mathematics for Quantum Mechanics.** Hilbert space, self-adjoint operators, the mathematical model of quantum mechanics, commutation relations, spectral analysis of Hamiltonians, time dependent scattering theory. Prerequisites: Mathematics 230 and 231 or equivalents. 3 units. *Staff*

**235. Topics in Mathematical Physics.** Group representations, perturbation theory, quantum field theory, statistical mechanics, or general relativity. Prerequisite: Mathematics 231 or equivalent. 3 units. *Staff*

**238, 239. Topics in Applied Mathematics.** Conceptual basis of applied mathematics, combinatorics, graph theory, game theory, mathematical programming, or numerical solution of ordinary and partial differential equations. Prerequisites: Mathematics 103 and 104 or equivalents. 6 units. *Staff*

**240. Applied Stochastic Processes.** Applications of probability theory and stochastic processes to economics and environmental science. Markoff chains, optional stopping, queuing theory, decision theory, birth and death processes, and the Monte Carlo method. Prerequisite: Mathematics 135 or equivalent. 3 units. *Staff*

**241. Linear Models.** Geometric interpretation, multiple regression, analysis of variance, experimental design, analysis of covariance. Prerequisite: Mathematics 136 or equivalent. 3 units. *Staff*

**242. Multivariate Statistics.** Multinormal distributions, multivariate general linear model, Hotelling's  $T^2$  statistic, Roy union-intersection principle, principal components, canonical analysis, factor analysis. Prerequisite: Mathematics 241 or equivalent. 3 units. *Staff*

**245. Functional Analysis for Scientific Computing.** See C-L: Computer Science 245. 3 units. *Rose or Szyld*

**250. Introductory Mathematical Logic.** First-order logic, completeness theorem, compactness theorem, introduction to recursive functions, incompleteness theorem. Prerequisite: Mathematics 187 or Mathematics 200 or equivalent. 3 units. *Staff*

**251. Set Theory I.** Zermelo-Fraenkel axioms, ordinals and cardinals, models of set theory, constructible sets. Prerequisite: Mathematics 187 or Mathematics 200 or equivalent. 3 units. *Staff*

**252. Set Theory II.** Forcing, large cardinals, determinateness, and other advanced topics. Prerequisite: Mathematics 251. 3 units. *Staff*

**253. Recursion Theory.** Register and Turing machines; recursive functions and sets; enumeration theorem; recursively enumerable sets; arithmetical and analytic hierarchies; degrees; unsolvable problems; complexity theory. Prerequisite: Mathematics 187 or Mathematics 200 or equivalent. 3 units. *Staff*

**258, 259. Topics in Logic.** Model theory, recursion theory, set theory, or other fields of logic. Prerequisite: Mathematics 250 or equivalent. 6 units. *Staff*

**260. Groups, Rings, and Fields.** Groups including nilpotent and solvable groups,  $p$ -groups and Sylow theorems; rings and modules including classification of modules over a PID and applications to linear algebra; fields including extensions and Galois theory. Prerequisite: Mathematics 201 or equivalent. 3 units. *Staff*

**261. Commutative Algebra.** Extension and contraction of ideals, modules of fractions, primary decomposition, integral dependence, chain conditions, affine algebraic varieties, Dedekind domains, completions. Prerequisite: Mathematics 260 or equivalent. 3 units. *Staff*

**268, 269. Topics in Algebra.** Algebraic number theory, algebraic  $K$ -theory, homological algebra, or topological algebra. Prerequisite: Mathematics 260. 6 units. *Staff*

**271. Algebraic Topology.** Fundamental group and covering spaces, homology groups of cell complexes, classification of compact surfaces, the cohomology ring, and Poincaré duality for manifolds. Prerequisites: Mathematics 171S and 200 or equivalents. 3 units. *Staff*

**273. Algebraic Geometry.** Local theory: affine varieties, algebraic and topological theory of singularities. Global theory over the complex numbers: Riemann surfaces, Jacobians, Kähler manifolds, Hodge theory, theorems of Lefschetz and Kodaira. Prerequisite: Mathematics 261 or equivalent. 3 units. *Staff*

**275. Differential Geometry.** Differentiable manifolds, fiber bundles, connections, curvature, characteristic classes, Riemannian geometry including submanifolds and variations of the length integral, complex manifolds, homogeneous spaces. Prerequisites: Mathematics 204 and 260 or equivalents. 3 units. *Staff*

**276. Topics in Differential Geometry.** Lie groups and related topics, Hodge theory, index theory, minimal surfaces, Yang-Mills fields, exterior differential systems, several complex variables. Prerequisite: Mathematics 275 or consent of instructor. 3 units. *Staff*

**277. Topics in Algebraic Geometry.** Projective varieties and the theory of extremal rays, classification of surfaces and higher-dimensional varieties, variation of Hodge structure and moduli problems, schemes and arithmetic varieties, or other advanced topics. Prerequisite: Mathematics 273 or consent of instructor. 3 units. *Staff*

**278, 279. Topics in Topology.** Point set, algebraic, geometric, or differential topology. Prerequisite: consent of instructor. 6 units. *Staff*



- 280. Differential Analysis.** Differential calculus, ordinary differential equations, flows, Lie bracket, total differential equations, first order partial differential equations, deRham theory. Prerequisite: Mathematics 140 or equivalent. 3 units. *Staff*
- 281. Real Analysis I.** Measures, Lebesgue integral,  $L^p$ -spaces, Daniell integral, differentiation theory, product measures. Prerequisite: Mathematics 204 or equivalent. 3 units. *Staff*
- 282. Real Analysis II.** Metric spaces, fixed point theorems, Baire category theorem, Banach spaces, fundamental theorems of functional analysis, Fourier transform. Prerequisite: Mathematics 281 or equivalent. 3 units. *Staff*
- 283. Linear Operators.** Bounded and unbounded operators on Banach and Hilbert spaces, symmetric and self-adjoint operators, Banach algebras, spectral theorem, unitary groups, compact operators, Fredholm theory, accretive operators, semigroups of operators. Prerequisite: Mathematics 282 or equivalent. 3 units. *Staff*
- 284. Topics in Functional Analysis.** Advanced spectral analysis, operator algebras, nonlinear functional analysis, or structure theory of Banach spaces. Prerequisite: Mathematics 282 or equivalent. 3 units. *Staff*
- 285. Complex Analysis.** Complex calculus, conformal mapping, Riemann mapping theorem, Riemann surfaces. Prerequisite: Mathematics 140 or equivalent. 3 units. *Staff*
- 286. Topics in Complex Analysis.** Geometric function theory, function algebras, several complex variables, uniformization, or analytic number theory. Prerequisite: Mathematics 285 or equivalent. 3 units. *Staff*
- 288, 289. Topics in Analysis.** Harmonic analysis, dynamical systems, geometric measure theory, or calculus of variations. Prerequisites: Mathematics 281 and 285 or equivalents. 6 units. *Staff*
- 290. Probability.** Random variables, independence, expectations, laws of large numbers, central limit theorem, Markoff chains. Prerequisite: Mathematics 281 or equivalent. 3 units. *Staff*
- 293, 294. Topics in Probability Theory.** Ergodic theory, multiparameter stochastic processes and random fields, stochastic control theory, or stochastic differential equations. Prerequisite: Mathematics 290 or consent of instructor. 6 units. *Staff*
- 295. Fourier Analysis and Distribution Theory.** Tempered distributions, Fourier transforms, classical inequalities, and oscillatory integrals. Prerequisites: Mathematics 204 and 285 or equivalents. 3 units. *Staff*
- 296. Ordinary Differential Equations.** Existence and uniqueness theorems for nonlinear systems, well-posedness, two-point boundary value problems, phase plane diagrams, stability, dynamical systems, and strange attractors. Prerequisites: Mathematics 104, 111 or 131, and 203 or 139. 3 units. *Staff*
- 297. Partial Differential Equations I.** Fundamental solutions of linear partial differential equations, hyperbolic equations, characteristics, Cauchy-Kowalevski theorem, propagation of singularities. Prerequisite: Mathematics 204 or equivalent. 3 units. *Staff*
- 298. Partial Differential Equations II.** Elliptic boundary value problems, regularity theorems, the diffusion equation, and nonlinear equations. Prerequisite: Mathematics 297 or equivalent. 3 units. *Staff*
- 299. Topics in Partial Differential Equations.** Hyperbolic conservation laws, pseudo-differential operators, variational inequalities, theoretical continuum mechanics. Prerequisite: 298 or equivalent. 3 units. *Staff*
- 378-379. Current Research in Topology.** 6 units. *Staff*

388, 389. Current Research in Analysis. 6 units. *Staff*

## COURSES CURRENTLY UNSCHEDULED

358-359. Current Research in Logic

368-369. Current Research in Algebra

387. Current Research in Mathematical Physics

## Program in Medieval and Renaissance Studies

Professor L. Patterson, *Chairman* (402 Allen)

Professor Charles R. Young, *Director of Graduate Studies* (102 West Duke)

The graduate Program in Medieval and Renaissance Studies is an interdisciplinary program administered by the Duke University Center for Medieval and Renaissance Studies. In consultation with the Director of Graduate Studies, students in the program select courses in art, history, music, philosophy, religion, language, and literature (classical studies, English, German, and Romance languages). For descriptions of the individual courses see the listings under the specified department.

### DEPARTMENT OF ART AND ART HISTORY

230S. Medieval and Byzantine Art and Architecture. *Bruzelius or Wharton*

232S. Romanesque and Gothic Art and Architecture. *Bruzelius*

234. Medieval Architecture. *Bruzelius*

242S. Studies in Italian Renaissance Art. *Spencer*

243S. Studies in Northern Art. *van Migroet*

### DEPARTMENT OF CLASSICAL STUDIES

221. Medieval Latin. *Newton*

### DEPARTMENT OF ENGLISH

208. History of the English Language. *Butters, Nygard, or Tetel*

212. Middle English Literature: 1100 to 1500. *Fish, Gopen, Nygard, or L. Patterson*

221. Renaissance Prose and Poetry: 1500 to 1660. *DeNeef, Fish, A. Patterson, Randall, Schwartz, or G. Williams*

225. Renaissance Drama: 1500 to 1642. *A. Patterson, Randall, or G. Williams*

312. Studies in Middle English Literature. *Fish, Nygard, or L. Patterson*

315. Studies in Chaucer. *Fish, Nygard, or L. Patterson*

321. Studies in Renaissance Literature. *DeNeef, Fish, A. Patterson, Randall, Schwartz, or G. Williams*

324. Studies in Shakespeare. *A. Patterson, Porter, or G. Williams*

329. Studies in Milton. *DeNeef, Fish, A. Patterson, or Schwartz*

### DEPARTMENT OF GERMANIC LANGUAGES AND LITERATURE

205, 206. Middle High German. *Rasmussen*

215S. Seventeenth-Century Literature. *Borchardt*

216. History of the German Language. *Rasmussen*

217S. Renaissance and Reformation Literature. *Borchardt*

### DEPARTMENT OF HISTORY

207. Constitutional History of Britain: The Rise of the Common Law. *Herrup*

221. Topics in the Social and Economic History of Europe, 1200-1700. *Staff*

222. Problems in the Intellectual History of the European Renaissance and Reformation. *Witt*

237S. Europe in the Early Middle Ages. *Young*

238S. Europe in the High Middle Ages. *Young*

267S-268S. From Medieval to Early Modern England. *Herrup*

### DEPARTMENT OF MUSIC

211, 212. Notation. *Higgins or Williams*

222. Music in the Middle Ages. *Higgins or Seebass*

223. Music in the Renaissance. *Higgins or Silbiger*

317S. Seminar in the History of Music. (Topics vary.) *Staff*

341S. History of Music Theory to Rameau. *Silbiger*

- 351S. Studies in Musical Iconography. *Seebass*  
361S. Music Organology. *Seebass or Williams*

#### DEPARTMENT OF PHILOSOPHY

- 218S. Medieval Philosophy. *Mahoney*  
219S. Late Medieval and Renaissance Philosophy. *Mahoney*

#### DEPARTMENT OF RELIGION

219. Augustine. *Clark*  
236. Luther and the Reformation in Germany. *Steinmetz*  
241. Problems in Reformation Theology. *Steinmetz*  
334. Theology and Reform in the Later Middle Ages. *Steinmetz*  
337. Theology of St. Thomas Aquinas. *Staff*  
338. Calvin and the Reformed Tradition. *Steinmetz*  
339. The Radical Reformation. *Steinmetz*

#### DEPARTMENT OF ROMANCE STUDIES

##### French

211. History of the French Language. *Hull*  
240. Old French Literature. *Solterer*  
248. French Literature of the Seventeenth Century. *Ferrell*  
325. French Prose of the Sixteenth Century. *Tétel*  
326. Topics in Renaissance Poetry. *Tétel*  
391, 392. French Seminar (medieval and Renaissance topics). *Tétel and staff*

##### Italian

- 284, 285. Dante. *Caserta*

##### Spanish

210. History of the Spanish Language. *Garci-Gómez*  
251. The Origins of Spanish Prose Fiction. *Wardropper*  
253. Cervantes. *Wardropper*  
254. Drama of the Golden Age. *Wardropper*  
258S. Spanish Lyric Poetry before 1700. *Wardropper*  
391, 392. Hispanic Seminar (medieval and Renaissance topics). *Staff*

#### COURSES CURRENTLY UNSCHEDULED

- Classical Studies 327. Seminar in Byzantine History  
English 310. Studies in Old English Literature  
English 383. Textual Criticism  
Religion 206. Christian Mysticism in the Middle Ages  
Religion 251. The Counter-Reformation and the Development of Catholic Dogma  
Religion 344. Zwingli and the Origins of Reformed Theology

## Microbiology and Immunology

Professor Joklik, *Chairman* (414A Jones); Professor Willett, *Director of Graduate Studies* (420 Jones); Professors Amos, Bastia, Bolognesi, R. Buckley, Cresswell, McClay, Metzgar, Nevins, Osterhout, Rosse, Seigler, Ward, and Wheat; Associate Professors Adams, Corley, Dawson, Endow, Greene, Haynes, Keene, Linney, Mitchell, Ruderman, and Sage; Assistant Professors Argon, C. E. Buckley, Finn, Kreuzer, Ostrowski, Pickup, and Pisetsky; Associate Medical Research Professors Balber and Miller; Assistant Medical Research Professors Burdett and Singer

The department offers graduate work leading to the Ph.D. degree. Research programs are available in many areas of molecular prokaryotic and eukaryotic genetics and cell biology--molecular viology, viral oncology, cellular differentiation and development, tumor cell biology, immunogenetics, molecular and cellular immunology, and mycology. The department is also a participating member of the interdisciplinary University Programs in Genetics, Cell and Molecular Biology, and the Medical Scientist Training Program.



Undergraduate preparation in the biological and physical sciences and in biochemistry is required. A brochure describing the Ph.D. degree program, prerequisites for admission, and research in the department may be obtained by writing the Director of Graduate Studies, Box 3020, Duke University Medical Center, Durham, North Carolina 27710.

**214. Fundamentals of Electron Microscopy.** Introduction to the basics of transmission electron microscopy. Specimen preparation techniques include: grid preparation, negative staining, metal shadowing, nucleic acid spreading, embedding, and thin sectioning. Students gain experience in the use of the ultramicrotome and electron microscope by working on their own projects. Additional techniques included are ultracryotomy immunoelectron microscopy, freeze-fracture, scanning electron microscopy, and X-ray spectroscopy. 3 units. *Miller*

**219. Molecular and Cellular Bases of Differentiation.** See C-L: Cell Biology 219; also C-L: Biochemistry 219 and Pathology 219. *Counce and staff*

**221. Medical Microbiology.** An intensive study of common bacteria, viruses, fungi, and parasites which cause disease in humans. The didactic portion of the course focuses on the nature and biological properties of microorganisms causing disease, the manner of their multiplication, and their interaction with the entire host as well as specific organs and cells. 4 units. *Joklik and staff*

**244. Principles of Immunology.** An introduction to the molecular and cellular basis of the immune response. Topics include anatomy of the lymphoid system, lymphocyte biology, antigen-antibody interactions, humoral and cellular effector mechanisms, and control of immune responses. Prerequisites: Biology 160 and Chemistry 152 and consent of instructor. C-L: Zoology 244. 3 units. *Amos, McClay, and staff*

**246S. Parasitic Diseases.** Topics in the physiology and immunology of major human and animal parasites with an emphasis on protozoa and schistosomes. Extensive reading in and discussion of current literature. Basic parasitology developed in introductory readings and lectures. Prerequisites: Microbiology and Immunology 244 or 291, and Biochemistry 227 or equivalent. 3 units. *Balber*

**252. General Virology and Viral Oncology.** The first half of the course will be devoted to a discussion of the structure and replication of mammalian and bacterial viruses. The second half deals specifically with tumor viruses, which are discussed in terms of the virus-cell interaction, the relationship of virus infection to neoplasia, and the role of the immunological response to tumor virus infection. Prerequisite: consent of instructor. 4 units. *Keene and staff*

**259. Molecular Biology I: Protein and Membrane Structure/Function.** See C-L: The University Program in Cell and Molecular Biology; also C-L: Biochemistry 259 and Cell Biology 259. 3 units. *Erickson and staff*

**268. Molecular Biology II: Nucleic Acids.** See C-L: Biochemistry 268; also C-L: Cell Biology 268, The University Program in Cell and Molecular Biology, and The University Program in Genetics. 4 units. *Modrich and staff*

**269. Advanced Cell Biology.** See C-L: The University Program in Cell and Molecular Biology; also C-L: Botany 269, Cell Biology 269, and Zoology 269. 3 units. *McClay and staff*

**291. Comprehensive Immunology.** An intensive course in the biology of the immune system and the structure and function of its component parts. Major topics discussed are: properties of antigens; specificity of antibody molecules and their biologic functions; cells and organs of the lymphoid system; structure and function of complement; inflammation and nonspecific effector mechanisms; cellular interactions and soluble mediators in lymphocyte activation, replication, and differentiation; regulation of immune responses;

neoplasia and the immune system; molecular structure and genetic organization of (a) immunoglobulins, (b) histocompatibility antigens, and T-cell receptor. 4 units. *Argon, Finn, and staff*

### For Graduates

**304. Molecular Membrane Biology.** An advanced seminar course covering selected aspects of current research on biogenesis and dynamics of various cellular membranes. Emphasis will be on the cell biology of the immune system. Discussion topics will represent the following areas: biosynthesis of membrane proteins; intracellular transport vesicles; endocytosis; signal transduction across the plasma membrane; intracellular organelles and protein sorting; cell interactions in differentiation. Prerequisite: Microbiology 269 or consent of instructor. 2 units. *Argon and Cresswell*

**310. Molecular Development.** Selected topics of current research using molecular and genetic approaches to study development and developmental gene regulation in eukaryotes. Lectures and student presentations of research with various developmental systems (e.g., *C. elegans*, *Drosophila*, mouse teratocarcinoma cells, and mouse embryos) will be included in the course. 2 units. *Linney and staff*

**324. Topics in Molecular Genetics.** An advanced treatment of selected topics and recent developments in molecular genetics. 2 units. *Staff*

**325. Medical Mycology.** Comprehensive lecture and laboratory coverage of all the fungi pathogenic for humans. Practical aspects as well as future trends in the mycology, immunology, diagnosis, pathogenesis, and epidemiology of each mycotic agent will be explored. There will be several invited lecturers, each an internationally recognized scientist, discussing his or her particular area of mycological expertise and current research. Prerequisite: consent of instructor. 4 units. *Mitchell*

**330. Medical Immunology.** A comprehensive course in medical immunology which attempts to define the role that immunology plays in the etiology, diagnosis, nosology, and therapy of human disease. 6 units. *Ward and staff*

**331.1-331.8. Microbiology Seminar.** Current topics in microbiology with seminars presented by students, faculty, and outside speakers. Required course for all students specializing in microbiology. 1 unit each. *Staff*

**332.1-332.8. Immunology Seminar.** Current topics in immunology with seminars presented by students, faculty, and outside speakers. Required course for all students specializing in immunology. 1 unit each. *Staff*

**336. Contemporary Topics in Immunogenetics.** Selected themes in immunogenetics with special emphasis on molecular approaches. The major areas discussed are: the nature, interaction, and expression of immunoglobulin genes and T-cell receptor genes, the genes of the major histocompatibility complex, and the genes of the T/t complex. The central ideas discussed include the manner in which cells recognize and interact with each other in phylogeny, ontogeny, and in differentiation; how gene families evolve and interact; and how information about these complex genetic systems is used in basic research and in clinical medicine. Prerequisite: Microbiology and Immunology 244 or 291 or 330 or equivalent. C-L: The University Program in Genetics. 2 units. *Amos and Ward*

### COURSES CURRENTLY UNSCHEDULED

234. Introduction to Biostatistical Methods

236. Statistical Methods in Human Genetics

282. Molecular Microbiology

323. Topics in Cell and Molecular Biology

# Music

Professor Silbiger, *Acting Chairman* (105 Mary Duke Biddle Music Building); Associate Professor Seebass, *Acting Director of Graduate Studies* (054 Mary Duke Biddle Music Building); Professor Williams; Associate Professors Jaffe and Todd; Assistant Professors Bartlett, Gilliam, Higgins, and Hill; Adjunct Assistant Professor Druesedow, *Director of Music Library*

The Department of Music offers graduate programs leading to the A.M. and Ph.D. degrees in musicology, the A.M. degree in composition, and the A.M. degree in performance practice. The department has traditionally emphasized the study of music within the framework of cultural and intellectual history. To this has been added more recently an emphasis on performance practice. In addition, there is a strong interest, within both the composition and musicology programs, in opera and musical theater. Students are encouraged to include work outside their main area of concentration in their degree programs.

Nondegree students and especially graduate students from other departments may be admitted to graduate courses by consent of the instructor, according to their level of achievement in the proposed area of study. Students may be admitted to the Program in Medieval and Renaissance Studies (see section on Medieval and Renaissance Studies). A reading knowledge of one foreign language is required for the A.M. in composition, musicology, and performance practice; a minimum of two languages is required for the Ph.D. (one of which will normally need to be German). For many dissertation topics a third language may be required.

A detailed description of the requirements for the A.M. and Ph.D. is available upon request from the Director of Graduate Studies.

**201. Introduction to Musicology.** Methods of research on music and its history, including studies of musical and literary sources, iconography, performance practice, ethnomusicology, and historical analysis, with special attention to the interrelationships of these approaches. 3 units. *Druesedow or Seebass*

**203. Proseminar in Performance Practice.** Critical methods in the study of historical performance practice, including the evaluation of evidence provided by musical and theoretical sources, archival and iconographic materials, instruments, and sound recordings. Current issues regarding the performance practice for music from the middle ages to the twentieth century. 3 units. *Silbiger*

**211, 212. Notation.** A comprehensive course tracing the development and changing function of musical notation from ca. 900 to ca. 1900, including plainchant notations, black notations, white notations, the invention of printing (particularly movable type and engraving), keyboard and lute tablatures, scores. 6 units. *Higgins or Williams*

**213. Theories and Notation of Contemporary Music.** The diverse languages of contemporary music and their roots in the early twentieth century, with emphasis on the problems and continuity of musical language. Recent composers and their stylistic progenitors (e.g., Ligeti, Bartók, and Berg; Carter, Schoenberg, Ives and Copland; Crumb, Messiaen, and Webern; Cage, Varèse, Cowell and Stockhausen). 3 units. *Jaffe*

**215. Music Analysis.** Historical, philosophical, and ideological issues raised by music analysis. Intensive study of harmony and voice leading in the works of major tonal composers, with emphasis on the analytic approach of Heinrich Schenker. 3 units. *Hill or Todd*

Courses dealing with selected topics in the period concerned, at a level between simple surveys and advanced seminars:



222. **Music in the Middle Ages.** 3 units. *Higgins or Seebass*

223. **Music in the Renaissance.** 3 units. *Higgins or Silbiger*

224. **Music in the Baroque Era.** 3 units. *Silbiger or Williams*

225. **Music in the Classic Era.** 3 units. *Bartlet, Seebass, or Todd*

226. **Music in the Nineteenth Century.** 3 units. *Bartlet, Gilliam, or Todd*

227. **Music in the Twentieth Century.** 3 units. *Gilliam or Todd*

236. **Nineteenth-Century Piano Music.** Beethoven, Schubert, Weber, Mendelssohn, Schumann, Chopin, Liszt, and Brahms. The arts of improvisation and transcription, the keyboard virtuoso, the character piece, and the conflict between romantic content and form. 3 units. *Todd*

295S. **Composition Seminar.** Selected topics in composition, including original composition in stylized genres (for example, classical-period sonata, romantic piano piece, free atonal song) as well as free composition on given materials. Related topics in form, harmony, and instrumentation. 3 units. *Jaffe*

296S. **Analysis of Contemporary Music.** Structures, expressive intentions, and functions since 1914. Contemporary orchestral music, American music, European music, popular media, musical tradition, and contemporary composers. Analysis of works performed in the department's Encounters Series with occasional guest composers present. 3 units. *Jaffe*

297, 298, 299. **Composition.** Weekly independent study sessions at an advanced level with a member of the graduate faculty in composition. 3 units. *Jaffe*

317S. **Seminar in the History of Music.** Selected topics. 3 units. *Staff*

318S. **Seminar in Performance Practice.** A practical seminar in which participants will be expected to perform, to introduce the work to be played or sung, and to outline its interpretative problems. A list of the music concerned will be posted in advance, and all students will participate in the study (if not necessarily in the performance) of the works announced. It is expected that the seminar will cover most periods, from Gregorian chant to twentieth-century repertoires. Prerequisite: consent of the instructor. 3 units. *Williams*

331, 332, 333. **Independent Study in Performance Practice and Interpretation.** The exploration of significant interpretive and performance-practice issues as they affect a specific repertory. Weekly meetings with a member of the graduate faculty. Prerequisites: consent of instructor and Director of Graduate Studies. 3 units. *Staff*

341S. **History of Music Theory to Rameau.** A study of writings on pitch systems (including monochord divisions and hexachord solmization), tonal relationships (including counterpoint and modal theories), and the organization of time (including mensural systems and proportions); implications for performance practice (e.g., intonation and temperaments, rhythm and tempo, *musica ficta*) and for the analysis of music from before 1700. 3 units. *Silbiger*

351S. **Studies in Musical Iconography.** The history and current trends in musical iconography; iconography as a part of the history of ideas and as *Realienforschung*, "the study of real objects." Discussion of papers in the area of interest of participants. 3 units. *Seebass*

361S. **Musical Organology.** Musical instruments in Western and non-Western music. Classification and organological literature. The primary function of instruments: their construction, their sound, and their impact on performance practice and the musical score. The secondary function of instruments: their social importance, their aesthetic and

scientific value, their religious symbolism. Iconography of instruments. 3 units. *Seebass or Williams*

**382S. Studies in Ethnomusicology.** Ethnomusicology as a branch of musicology. Discussion of papers in Southeast Asian music and in the areas of interest of the participants. 3 units. *Seebass*

**390. Independent Study.** With the consent of a graduate faculty member and the approval of the Director of Graduate Studies, the student will undertake a specialized research project of his/her own choosing. 3 units. *Staff*

## Neurobiology

Professor Hall, *Acting Chairman* (267 Sands); Professor Simon, *Director of Graduate Studies* (370 Nanaline H. Duke); Professors Diamond, Moore, Robertson, Somjen, and Staddon; Associate Professors Bennett, Cant, Corless, Erickson, Nadler, Tyrey, and Wolbarsht; Assistant Professors Anholt, Crain, Fitzpatrick, and Lewis; Professor Emeritus Everett; Assistant Medical Research Professors Aitken, Casseday, Hines, Raczkowski, and Schweitzer; Adjunct Assistant Professor Lin

Neurobiology is concerned with accounting for behavior in terms of the form, function, evolution, and development of structures in nervous systems. A wide range of tools and approaches are used in neuroscience research. These include: light and electron microscopy to reveal neuron and supporting cell shapes and connections as well as to visualize fluorescently labeled antibodies to identify the constituents of neural tissue; and electrical recording to measure electrical activity from individual cells and collections of cells at macroscopic and microscopic levels. These measurements include voltage and patch clamping of individual cells; optical recording ranging from noninvasive studies of intracellular messengers to detecting impulses in spatially distributed cells; biochemical techniques to identify the chemical machinery involved in signal transduction and cell regulation; molecular biology to determine the effects of perturbations of molecular constituents on development and macromolecule function; and computer simulations to understand the functioning of neurons and neuron networks.

**202. Basic Neurobiology.** An integrated interdepartmental course designed for first-year medical students and other professional and graduate students who need a core course on the morphology and functions of the mammalian nervous system. Lectures, laboratory demonstrations, clinical conferences, and lecture conferences during the month of January only. 4 units. *Hall, Moore, and Somjen*

**208. Cellular Physiology of Nervous Tissue I.** Basic principles of the transport of nonelectrolytes and electrolytes across biological and model membranes. The course uses physicochemical principles to provide a comprehensive understanding of phenomena such as surface charge, gating, channels, selectivity, and reactions at electrode surfaces. The methodology and conceptual framework for the study of transport is described with selected examples from bilayers and nerves. Physical chemistry is recommended. Prerequisite: consent of instructor. Fall. 3 units. *Anholt, Moore, Nadler, and Simon*

**209. Cellular Physiology of Nervous Tissue II.** Role of ionic channels in generation of action potentials, impulse propagation in various morphologies, and transmission at synapses. Modulation and control of channel and synaptic properties by drugs, toxins, and second messengers. Computer simulations of several of these phenomena will be shown. Prerequisite: consent of instructor. Spring. 3 units. *Moore, Nadler, and Simon*

**210. Individual Study.** Directed reading and research in neurobiology. Prerequisite: consent of Director of Graduate Studies. 3 to 9 units each. *Staff*

**222. Behavioral and Neural Modeling.** The nervous system as controller of adaptive behavior. Basic facts and principles of perception, learning, and memory. Theory of neural networks. Formal networks as models for behavior and neural systems. Spring. 3 units. *Moore, Staddon, and staff*

**225. Neurobiology of Sensory Systems.** An interdisciplinary course dealing with principles involved in the structure, biochemistry, and electrophysiology of sensory systems. The major focus is on the visual system with lesser emphasis on auditory, gustatory, olfactory, and somatic-sensory systems. Systems will be examined from the receptor to the cortical levels. C-L: Cell Biology 225. Spring. 3 units. *Simon, Corless, and guest lecturers*

**280. Student Seminar.** Preparation and presentation of seminars to students and faculty on topics of broad interest to cell biology, neurobiology, and physiology. Required of all neurobiology students. C-L: Cell Biology 280. 2 units. *Anholt*

**302. Anatomy and Physiology of the Central Nervous System.** The course begins with an intensive one-month overview of the morphology and functions of the mammalian nervous system and then turns to the discussion of original papers by pioneers in the study of the structure and function of the central nervous system of vertebrates. Spring. 4 units. *Staff*

**310. Frontiers in Neurobiology.** Course consists of readings and student and faculty presentations of current problems in neurobiology. 3 units. *Cant and Hall*

**360. Neuropharmacology.** Seminar-lecture course emphasizing neurotransmitter mechanisms and the mechanisms of action of drugs used to modify nervous system function. Material will be drawn from recent literature. Prerequisite: consent of instructor. C-L: Pharmacology 360. 3 units. *Nadler*

**370. Neurobiology I.** Interdisciplinary approach to neuronal function at the cellular and molecular levels. Focus is on the anatomy, biophysics, biochemistry, and pharmacology of conductance and transmission of the neuronal impulse. C-L: Pharmacology 370. 3 units. *Kirschner and staff*

**372. Research in Neurobiology.** Laboratory investigation in various areas of neurobiology. Credit to be arranged. *Staff*

## Pathology

Professor Jennings, *Chairman* (301B Davison); Professor D. Bigner, *Director of Graduate Studies* (207 Jones); Professors Adams, S. Bigner, Bossen, Bradford, Burger, Fetter, Graham, Hackel, Johnston, Klintworth, Koepke, Michalopoulos, Pizzo, Pratt, Shelburne, Sommer, Vogel, and Wittels; Associate Professors Elchlepp, Ideker, McCarty, Reimer, Sanfilippo, and Zwadyk; Assistant Professors Abernethy, Crapo, Jirtle, Schold, and Zalutsky; Associate Medical Research Professor Wikstrand; Assistant Clinical Professor Vollmer; Adjunct Associate Professor Swenberg; Adjunct Assistant Professor Brody

The Department of Pathology offers graduate work leading to the M.S. and Ph.D. degrees with areas of specialization such as subcellular and molecular pathology. Course work is designed to give a broad background in classical and modern pathology with emphasis on the application of modern research techniques. Students will be required to take such courses as are necessary to obtain a broad foundation, as well as courses applicable to areas of speciality and research. Further information including brochures giving details of departmental facilities, staff, trainee stipends, and the M.D.-Ph.D. program are available from the Director of Graduate Studies.

**219. Molecular and Cellular Bases of Differentiation.** See C-L: Cell Biology 219; also C-L: Biochemistry 219 and Microbiology and Immunology 219. 3 units. *Counce and staff*



**250. General Pathology.** The fundamentals of pathology are presented to the student. Lectures developing broad concepts of disease processes are given by the members of the senior staff. The emphasis is placed on etiology and pathogenesis of disease. Lectures. Prerequisites: histology and consent of instructor. 4 units. *Hackel and staff*

**251. Laboratory Course in General Pathology.** Laboratory session to complement Pathology 250. Gross and microscopic material is correlated with and related to disease processes. Pathology 250 may be taken concurrently. Prerequisites: histology and consent of instructor. 4 units. *Hackel or staff*

**258. Cellular and Subcellular Pathology.** This course is designed for students wishing to broaden their knowledge of cellular structure and cellular pathology. The course consists of lectures and seminars discussing the alterations in cellular structure and associated functions that accompany cell injury. Prerequisite: consent of instructor. Hours to be arranged. 2 units. *Shelburne and Sommer*

**275. Fundamentals of Electron Microscopy and Biological Microanalysis.** Emphasis will be placed on preparative procedures including freezing techniques and on the application of electron microscopy to ultrastructural pathology. Scanning electron microscopy, X-ray microanalysis, and scanning ion microscopy will be discussed in addition to conventional transmission electron microscopy. Limited laboratory experience included. 3 units. *Brody, Ingram, Shelburne, and Sommer*

**325. Cardiovascular Pathology.** Cardiovascular disease processes will be studied, reviewing anatomic, embryologic, and physiologic features, and utilizing case material and gross specimens. Consideration will be given to principles of electrocardiography. Prerequisite: consent of instructor. 3 units. *Hackel*

**353. Advanced Neuropathology.** This course deals with current problems and research methods related to diseases which affect the nervous system. Prerequisite: consent of instructor. 3 units. *Vogel*

**355. Graduate Seminar in Pathology.** Discussions outlining the scope of modern pathology. This will include reports of original researchers by members of staff and visitors. 1 unit. *Bigner and staff*

**357. Research in Pathology.** Independent research projects in various fields of pathology. Hours and credit to be arranged. *Graduate faculty*

**361, 362. Autopsy Pathology.** A detailed consideration of the morphologic, physiologic, and biochemical manifestations of disease. Emphasis is on individual work in the laboratory with tutorial supervision. Gross dissection; histologic examination; processing; analyzing of morphologic, microbiologic, and biochemical data; and interpretation of results. For advanced students. Prerequisites: Pathology 250 and consent of instructor. 3 to 6 units each. *Adams and staff*

**364. Systemic Pathology.** Systematic presentation of the characteristics of disease processes as they affect specific organ systems. Prerequisite: consent of instructor. 6 units. *Hackel and staff*

**367. Special Topics in Pathology.** Special problems in pathology will be studied with a member of the senior staff; the subject matter will be individually arranged. Hours to be arranged. 2 to 4 units. *Jennings and staff*

**369. Ophthalmic Pathology.** This course will consist of lectures, seminars, and laboratory sessions. The normal anatomy and embryology of the eye will be reviewed as a basis for the study of the various ocular disease processes. The more common diseases of the eye will be considered in detail. Problems in ophthalmic pathology will be discussed together with methods of solving them. 3 units. *Klintworth*

**370. Developmental Pathology and Teratology.** A systematic study of disease processes involving the prenatal, natal, and postnatal period. Emphasis will be placed on developmental anatomy and teratogenesis. The format includes seminars and clinicopathological correlations derived from gross and microscopic material. Prerequisites: Pathology 250 and anatomy and histology. 3 units. *Bradford*

**374. Pulmonary Pathology and Postmortem Pathophysiology.** Emphasis will be on pulmonary pathology and pathophysiology of infectious, metabolic, environmental, and neoplastic diseases, and certain diseases of unknown etiology (e.g., sarcoid, alveolar proteinosis). Ventilatory experiments will be done on excised human lungs. 3 units. *Pratt*

**377. Pathology of the Kidney.** The course includes a comprehensive study of pathological, immunological, and clinical features of glomerulonephritis, and pyelonephritis, as well as of metabolic, congenital, and neoplastic renal disorders. Lectures will be supplemented with gross and microscopic specimens, demonstrations, and special library studies. 3 units. *Sanfilippo*

**380. Diagnostic Immunology.** Diagnostic and laboratory procedures used in evaluating immunologic diseases: especially autoimmune, infectious, immunodeficiency, immunoproliferative, and hypersensitivity disorders. Emphasis is placed on the theoretical and practical aspects of testing procedures and their proper interpretation. Prerequisite: consent of instructor. 2 units. *R. Buckley, Sanfilippo, and Zwadyk*

**381. Cancer Biology.** Emphasis of the course will be on cellular biology of the cancer cell. The instructors will present topics on aspects of cancer research and will attempt to correlate them with the biologic and clinical behavior of specific forms of neoplasia. 2 units. *Falletta and Michalopoulos*

**382. General Pathology for Toxicologists.** General principles of pathology using examples from human and experimental toxicological disease. Prerequisites: courses in biochemistry, physiology, and histology (histology may be taken concurrently). 3 units. *Graham, Jennings, and pathologists from UNC and Research Triangle Park*

## COURSES CURRENTLY UNSCHEDULED

### 360. Cytochemistry

## Pharmacology

Professor Schanberg, *Acting Chairman* (439 Nanaline H. Duke); Professor Mills, *Director of Graduate Studies* (432 Nanaline H. Duke); Professors Abou-Donia, Ellinwood, Kirshner, Lack, Ottolenghi, Slotkin, Strauss, Watkins, and Wilder; Associate Professors Davis, Kuhn, McNamara, Nadler, Nemeroff, Niedel, and Whorton; Assistant Professors Kilts and Schwartz; Professor Emeritus Bernheim; Medical Research Professor Elion; Associate Medical Research Professors Bartolome and Wilson; Assistant Medical Research Professors Lapadula, Seidler, and Wolpert

The Department of Pharmacology offers a graduate program which leads to the Ph.D. degree. Training is available in these areas of pharmacology: neuropharmacology, developmental, toxicology, biochemical, cardiovascular, molecular, and behavioral. Because pharmacology is an interdisciplinary field, the department gives serious consideration to applicants with strong undergraduate backgrounds in biological, chemical, and neural or behavioral sciences. There is no foreign language requirement.

### For Seniors and Graduates

**200. Pharmacology: Mode Action of Drugs.** Studies and discussion of the pharmacological action of drugs in terms of biochemical and physiological processes. Four lectures, one clinical correlation, and two conferences per week. 5 units. *Ottolenghi and staff*

**210, 211. Individual Study and Research.** Directed reading and research in pharmacology. Prerequisite: consent of Director of Graduate Studies. 3 to 9 units each. *Staff*

**219. Tutorial in Pharmacology.** Guided independent study of original literature. Credit to be arranged. *Staff*

**233. Principles of Pharmacology and Toxicology.** Drug absorption, distribution, excretion and metabolism; pharmacokinetics; Hansch correlation of structure and activity; stereochemistry; drug and hormone receptors and target cell responses. Prerequisites: biology, organic chemistry, differential and integral calculus. 4 units. *Slotkin and staff*

**254. Mammalian Toxicology.** Principles of toxicology as related to humans. Emphasis on the molecular basis for toxicity of chemical and physical agents. Subjects include metabolism and toxicokinetics, toxicologic evaluation, toxic agents, target organs, toxic effects, environmental toxicity, management of poisoning, epidemiology, risk assessment, and regulatory toxicology. Prerequisite: biology, organic chemistry or biochemistry or consent of instructor. 4 units. *Abou-Donia and staff*

**280. Student Seminar in Pharmacology.** Preparation and presentation of seminars to students and faculty on topics of broad interest to pharmacology. Required of all pharmacology graduate students. 2 units. *Whorton*

### For Graduates

**314. Integrated Case Studies in Toxicology.** Students are assigned topics relative to their chosen research discipline in toxicology and are asked to develop case studies to present at a roundtable workshop. Emphasis on review and analysis of toxicological problems from a holistic (multidisciplinary) viewpoint. C-L: Forestry and Environmental Studies 314. Spring. 1 unit. *Abou-Donia*

**331. Laboratory Methods in Pharmacology.** Tutorial laboratory training in various fields of pharmacology including neuropharmacology, cardiovascular pharmacology, biochemical pharmacology, and biophysical pharmacology. Prerequisite: consent of instructor. 3 to 6 units. *Staff*

**347, 348. Seminar in Toxicology.** A weekly research seminar throughout the year is required of participants in the Toxicology Program. Students, faculty, and invited speakers present their findings. 1 unit per semester. *Abou-Donia and Lynn*

**360. Neuropharmacology.** Seminar-lecture course emphasizing neurotransmitter mechanisms and the mechanisms of action of drugs used to modify nervous system function. Material will be drawn from recent literature. Prerequisite: consent of instructor. C-L: Neurobiology 360. 3 units. *Nadler*

**364. Neurotoxicology.** Adverse effects of drugs and toxicants on the central and peripheral nervous system; target sites and pathophysiology aspects of neurotoxicity; factors affecting neurotoxicity, screening and assessment of neurotoxicity in humans; experimental methodology for detection and screening of chemicals for neurotoxicity. 3 units. *Abou-Donia and staff*

**370. Neurobiology I.** See C-L: Neurobiology 370. 3 units. *Kirschner and staff*

**372. Research in Pharmacology.** Laboratory investigation in various areas of pharmacology. Credit to be arranged. *Staff*

**417. Cellular Endocrinology.** See C-L: Cell Biology 417. Fall. 3 units. *Caron, staff, and guest faculties*

**423. Neurobiological Basis of Behavior.** The course surveys neuroanatomical, neurophysiological, neurochemical, and neuropharmacological evidence of central nervous system function as it relates to normal and abnormal behavior. Clinical description, measurement of function, as well as the biological substrates of affective disorders and psy-



choses will be emphasized. Scientific bases of current therapeutic procedures, especially psychopharmacological, will be examined. Prerequisite: familiarity with basic neuroanatomy, neurophysiology, and neuropharmacology is assumed. 4 units. *Ellinwood and staff*

## COURSES CURRENTLY UNSCHEDULED

### 256. Human Nutrition

### 301. Physical Chemistry of Aqueous Solutions

## Philosophy

Professor Sanford, *Chairman* (201D West Duke); Associate Professor Brandon, *Director of Graduate Studies* (201C West Duke); Professors Golding and Mahoney; Associate Professor Posy; Assistant Professors Ferejohn, Lind, Roderick, and Vander Waerdt; Professors Emeriti Peach and Welsh

The Department of Philosophy offers graduate work leading to the A.M. and Ph.D. degrees. Tutorial work complements formal instruction. Students may, after taking a balanced program, specialize in any of the following fields: the history of philosophy, logic, philosophy of science, epistemology, metaphysics, philosophy of mind, philosophical analysis, ethics, aesthetics, political philosophy, philosophy of law, philosophy of medicine, and philosophy of religion.

Individual programs of study are developed for each student. Prior to being admitted to candidacy for the Ph.D. degree, the student must demonstrate a competence in one foreign language and must successfully complete a series of essays and examinations covering the following: logic and formal philosophy; value theory; metaphysics, epistemology, and philosophy of science; and the history of philosophy. In these exercises students are expected to combine factual knowledge with critical understanding.

Work in a minor or related field, not necessarily confined to any one department, is encouraged but not required. A minor normally includes 6 units for the A.M. or the Ph.D. degree and may include more as a student's program requires or permits.

A student who meets the general requirements of the Graduate School may earn the A.M. degree in philosophy by passing an oral master's examination. This examination, which can be the defense of either a master's thesis or an alternative academic exercise approved by the department and the student's committee, is normally given in the student's fourth term of full-time registration. The examination can be given earlier in two special circumstances:

1. A student with a strong undergraduate background in philosophy who satisfies the department of his or her qualifications by submitting several samples of written work before beginning the program may be admitted to the master's program with the understanding that the master's examination can be given in the second or third term of full-time registration.

2. A student who combines the A.M. program in philosophy with another advanced degree program, such as the programs for the J.D., the M.D., or the Ph.D. in another field, will register as a full-time graduate student of philosophy for only two terms, the minimum registration that meets the general requirements of the Graduate School for the A.M. degree. These two terms of full-time registration need not be consecutive, and their position in the student's overall program is determined in individual cases. A student in a combined program will normally do some work in philosophy while registered in the student's primary program and do some work in the primary field while registered in philosophy. The master's examination can be given in the second term of full-time registration as a philosophy graduate student or in a later term when the student is registered in the primary program.

A student in the philosophy Ph.D. program who meets the general requirements of the Graduate School for the A.M. degree may earn this degree by completing the preliminary exercises for the Ph.D. degree.

A reading knowledge of at least one foreign language, ancient or modern, is required for the Ph.D. degree. Students must satisfy this requirement by the end of the fifth semester of residency. More than one language may be required where this is judged appropriate to the research demanded by the candidate's dissertation.

### For Seniors and Graduates

**203S. Contemporary Ethical Theories.** The nature and justification of basic ethical concepts in the light of the chief ethical theories of twentieth-century British and American philosophers. 3 units. *Golding or Lind*

**204S. Philosophy of Law.** Natural law theory and positivism, the idea of obligation (legal, political, social, moral), and the relation of law and morality. 3 units. *Golding*

**205S. Topics in Philosophy of History.** Nature of historical knowledge and inquiry; theories of the historical process. 3 units. *Staff*

**206S. Responsibility.** The relationship between responsibility in the law and moral blameworthiness; excuses and defenses; the roles of such concepts as act, intention, motive, ignorance, and causation. 3 units. *Golding*

**208S. Political Values.** Analysis of the systematic justification of political principles and the political values in the administration of law. 3 units. *Golding*

**211S. Plato.** Selected dialogues. C-L: Classical Studies 211S. 3 units. *Ferejohn*

**217S. Aristotle.** Selected topics. C-L: Classical Studies 217S. 3 units. *Ferejohn*

**218S. Medieval Philosophy.** Selected problems. C-L: Medieval and Renaissance Studies. 3 units. *Mahoney*

**219S. Late Medieval and Renaissance Philosophy.** Selected problems. C-L: Medieval and Renaissance Studies. 3 units. *Mahoney*

**225S. British Empiricism.** A critical study of the writings of Locke, Berkeley, or Hume with special emphasis on problems in the theory of knowledge. 3 units. *Lind*

**227S. Continental Rationalism.** A critical study of the writings of Descartes, Spinoza, or Leibniz with special emphasis on problems in the theory of knowledge and metaphysics. 3 units. *Staff*

**228S. Recent and Contemporary Philosophy.** A critical study of some contemporary movements, with special emphasis on analytic philosophers. 3 units. *Posy*

**230S. The Meaning of Religious Language.** See C-L: Religion 230S. 3 units. *Staff*

**231S. Kant's Critique of Pure Reason.** 3 units. *Posy*

**233S. Methodology of the Empirical Sciences.** Recent philosophical discussion of the concept of a scientific explanation, the nature of laws, theory and observation, probability and induction, and other topics. Prerequisite: consent of instructor. 3 units. *Brandon*

**234S. Problems in the Philosophy of Biology.** Selected topics, with emphasis on evolutionary biology: the structure of evolutionary theory, adaptation, teleological or teleonomic explanations in biology, reductionism and organicism, the units of selection and sociobiology. Prerequisite: consent of instructor. C-L: Botany 234S and Zoology 234S. 3 units. *Brandon*

**235S. Nineteenth-Century German Philosophy.** A critical examination of the writings of Hegel, Marx, or Nietzsche. 3 units. *Roderick*

**250S. Topics in Formal Philosophy.** Topics selected from formal logic, philosophy of mathematics, philosophy of logic, or philosophy of language. 3 units. *Posy*

**251S. Epistemology.** Selected topics in the theory of knowledge, for example, conditions of knowledge, scepticism and certainty, perception, memory, knowledge of other minds, and knowledge of necessary truths. 3 units. *Sanford*

**252S. Metaphysics.** Selected topics: substance, qualities and universals, identity, space, time, causation, and determinism. 3 units. *Sanford*

**253S. Philosophy of Mind.** Analysis of concepts such as thought and belief; issues such as mind-body relations, thought and action, the nature of persons, and personal identity. 3 units. *Sanford*

**254S. Philosophy of Religion.** Topics such as proofs of the existence of God; meaningfulness of religious language; the problems of evil, immortality, and resurrection. 3 units. *Staff*

**291S, 292S. Special Fields of Philosophy.** 3 units each. *Staff*

### For Graduates

**300. Problems in the Theory of Value and Judgment.** See C-L: Literature 300; also C-L: English 386. 3 units. *Smith*

**311. Philosophy and Medicine.** The scope of medicine as a philosophical problem, the concept of health, and investigation of ethical issues arising in medical contexts. Prerequisite: consent of instructor. 3 units. *Golding*

### COURSES CURRENTLY UNSCHEDULED

**202S. Aesthetics: The Philosophy of Art**

**232S. Recent Continental Philosophy**

**331, 332. Seminar in Special Fields of Philosophy**

## Physical Therapy

Professor Bartlett, *Chairman* (045 Hospital); Associate Professor Branch, *Director of Graduate Studies* (045 Hospital); Associate Professors Villanueva and Malone; Assistant Professors Duncan, Gwyer, and Horton; Assistant Clinical Professor Riordan; Clinical Associates Chandler, Dore, and Lawrence

The Department of Physical Therapy offers an entry level professional program leading to the M.S. degree. To be eligible for admission to the program, applicants must have obtained a baccalaureate degree and have a background in the basic sciences and social sciences, including course work in biology, chemistry, physics, and psychology.

The program is designed to provide for integration of classroom knowledge and clinical learning experiences essential for the competent practice of physical therapy. In view of this integrated curriculum, failure in a major course within a semester would prevent the student from continuing in the program. Major courses are all courses offered by the Department of Physical Therapy as well as required courses offered by the Departments of Biological Anthropology and Anatomy, and Neurobiology. A grade of *F* (or *noncredit* in the case of Physical Therapy 342, 343, and 344) in any of these courses will occasion withdrawal from the program. Program requirements also include a comprehensive examination at the completion of the curriculum and a research project. Further information may be obtained from the Director of Graduate Studies, Department of Physical Therapy, Box 3965, Duke University Medical Center, Durham, North Carolina 27710.

**210. Independent Study.** Designed for nonmajors. Prerequisite: consent of instructor. Credit to be arranged. *Staff*



**301. Introduction to Scientific Inquiry.** Theory and methods of research process, research design, data collection, preparation of a research proposal. 2 units. *Gwyer and staff*

**303. Research.** Completion of a research project under the supervision of a faculty adviser; instruction in statistical techniques and the use of the computer. 3-5 units. *Staff*

**313. Physical Agents.** Physical aspects and physiological effects of selected physical agents, including massage, superficial heat and cold, ultraviolet, diathermy, and ultrasound. 2 units. *Branch*

**314. Electrotherapy and Electrodiagnosis.** Physical aspects and therapeutic effects of electrical currents. Electrodiagnostic testing, introduction to electromyography and nerve conduction studies. 1-2 units. *Staff*

**317. Kinesiology.** Fundamentals of arthrology and myology, movement and joint description, surface anatomy, principles of biomechanics and anthropometry. 2 units. *Villanueva*

**318. Arthrology and Pathokinesiology.** Detailed study of the arthrology and kinesiology of the trunk and limbs during normal and pathological conditions, with emphasis on the sequential electromyographic and joint motion analysis of body segments during selected human movement patterns, including locomotion. 3 units. *Villanueva*

**319. Introduction to Evaluation and Patient Care.** Orientation to basic patient care skills, including reaction to illness. Introduction to Problem-Oriented Record System. Principles and methods of evaluation, including assessment of muscle function, joint mobility, neurological and respiratory function, posture, gait, and physical level of independence. Opportunities for direct patient care in laboratory and clinic. 3 units. *Horton and Villanueva*

**320. Evaluation and Therapeutic Procedures I.** Specific assessment of neuromuscular and cardiopulmonary functions. Physiological basis of therapeutic intervention and specific exercise programs. 3 units. *Staff*

**321. Evaluation and Therapeutic Procedures II.** Assessment and treatment of specific neuromuscular and cardiopulmonary problems. Introduction to techniques of neuromuscular facilitation. 2 units. *Duncan and staff*

**322. Evaluation and Therapeutic Procedures III.** Introduction to the neurophysiological basis for evaluation and treatment of children and adults with central nervous system disorders; emphasis on assessment of abnormal movement and selection of appropriate therapeutic programs. Problems associated with spinal cord injuries, methods of therapeutic intervention, and functional testing. 3 units. *Bartlett and Duncan*

**332. Physical Therapy and Health Services: Administration and Issues.** Planning, organizing, delivering, and evaluating physical therapy and health services. Examination of health policy and issues. Principles of administration, leadership styles, and management roles. 2 units. *Bartlett and Riordan*

**333. Human Development: Pediatrics/Geriatrics.** Aspects of normal human development throughout the life cycle. Clinical features and management of common pediatric and geriatric problems. 2 units. *Riordan and staff*

**334. Introductory Pathology.** Fundamentals of pathology with emphasis on broad concepts of disease. 2 units. *Branch*

**335. Orthopedics.** Detailed examination of the musculoskeletal system, through lecture and laboratory, and the application of findings to the establishment of physical therapy care plans. Introduction to common orthopedic problems and their medical and surgical management. 2 units. *Lawrence*

**336. Medical Sciences.** The clinical manifestations and management of common medical and surgical disorders. Lectures by physicians, physical therapists, clinical pharmacists, and other health personnel; selected laboratory experiences. Areas covered include prosthetics and orthotics, burns, rheumatology, cardiopulmonary disorders, neurology, and neurosurgery. Seminars in patient management. 3 units. *Branch and staff*

**340. Special Topics in Physical Therapy.** Opportunity for study under the direction of an individual staff member. Prerequisite: consent of Director of Graduate Studies. Credit to be arranged. *Staff*

**343. Directed Clinical Experience in Physical Therapy II.** Full-time supervised clinical learning experiences in physical therapy settings within limited radius of the University. 2 units. *Clinical staffs*

**344. Directed Clinical Experience in Physical Therapy III.** Full-time supervised clinical learning experiences in physical therapy settings throughout the country. 3 units. *Clinical staffs*

## COURSES CURRENTLY UNSCHEDULED

**302. Research**

**304. Seminar in Applied Neurophysiology**

**324. Prosthetics and Orthotics**

**342. Directed Clinical Experience in Physical Therapy I**

## Physics

Professor Evans, *Chairman* (118 Physics); Professor Goshaw, *Director of Graduate Studies* (111 Physics); Professors Biedenharn, Bilpuch, De Lucia, Fortney, Han, Herbst, Johnson, Madey, Meyer, Roberson, Robinson, Walker, Walter, and Weller; Associate Professors Behringer, Greenside, Palmer, and Thomas; Assistant Professors Howell, Oh, and Teitsworth; Professors Emeriti Fairbank and Lewis; Adjunct Professors Ciftan, Guenther, O'Foghludha, Robl, and Strosio

The Department of Physics offers graduate work for students wishing to earn the A.M. or Ph.D. degree. In addition to a balanced program of basic graduate courses, the department offers specialized courses and seminars in several fields in which research is being done by faculty and staff.

With the help of faculty advisers, students select a course program to fit their needs, including work in a related field, usually mathematics or chemistry. Students are encouraged to begin research work early in their careers.

### For Seniors and Graduates

**211. Modern Physics.** Fundamental concepts of quantum theory applied mainly to study of atomic structure and spectra, and to statistical physics. Prerequisites: Physics 181 and Mathematics 111. 3 units. *Goshaw or Herbst*

**213. Introduction to Nonlinear Dynamics.** See C-L: Computer Science 213. 3 units. *Greenside*

**214. Introduction to Solid-State Physics.** Prerequisite: Physics 161 or equivalent. See C-L: Electrical Engineering 214. 3 units. *Hacker*

**215. Introduction to Quantum Mechanics.** Fundamental postulates; wave mechanics and elementary applications; operators, eigenvalues, and eigenfunctions; angular momentum and rotations; spin and coupling of angular momenta; perturbation theory, transition rates, and selection rules; identical particles; applications. Prerequisites: Physics 181 and 211; Mathematics 111 and 114 (may be taken concurrently). 3 units. *Robinson*

**217S, 218S. Advanced Physics Laboratory and Seminar.** Experiments involving the fields of electricity, magnetism, heat, optics, and modern physics. 6 units. *Meyer*

**220. Electronics.** Basic elements of modern electronics including AC circuits, transfer functions, solid-state circuits, transistor circuits, operational amplifier applications, digital circuits, and computer interfaces. 3 units. *Fortney*

**240. Computer Applications to Physical Measurement.** Hardware and software techniques for computer-assisted data acquisition, display, and control in the modern experimental environment. Theory and application of discrete signal analysis including digital filters, Z-transform, and fast Fourier transform. Lecture and laboratory. Prerequisite: Physics 171 or 220 or consent of instructor. 3 units. *Fortney*

**244. Nuclear and Particle Physics.** Current ideas and models in nuclear and particle physics. Experimental methods; nuclear structure; nuclear reactions; families of elementary particles; quarks and gluons; weak interactions. Prerequisite: Physics 211. 3 units. *Oh*

### For Graduates

**302. Advanced Mechanics.** The fundamental principles of Newtonian mechanics, general dynamics of systems of particles and rigid bodies, the methods of Lagrange and Hamilton, generalized mechanics. 3 units. *Fortney or Han*

**303. Statistical Mechanics.** Fundamental laws of thermodynamics and statistical mechanics with applications to physics and chemistry. Classical and quantum ideal gases; approximate methods for real gases and liquids. Prerequisite: Physics 215. 3 units. *Behringer*

**304. Advanced Topics in Statistical Mechanics.\*** This course will vary from year to year. Possible topics include Fermi liquids, systems of bosons, many-body theory, nonequilibrium statistical mechanics. Prerequisites: Physics 303 and 316. 3 units. *Staff*

**305. Introduction to Nuclear Physics.** Phenomenological aspects of nuclear physics, interaction of gamma radiation and charged particles with matter, nuclear detectors, particle accelerators, radioactivity, basic properties of nuclei, nuclear systematics, nuclear reactions, particle scattering, nuclear models of the deuteron, nuclear forces, parity. 3 units. *Weller*

**308. Introduction to High-Energy Physics.** High-energy processes; electromagnetic, weak, and strong interactions. Experimental instrumentation. 3 units. *Goshaw or Walker*

**309. Solid-State Physics I.** Properties of matter in the condensed state; crystal lattices, electrons in metals and semiconductors, band theory, nonmetallic solids, lattice dynamics, and phonons. Prerequisites: Physics 215 and 303. 3 units. *Palmer*

**316. Principles of Quantum Theory.** Original and fundamental concepts of quantum theory, wave and matrix mechanics, theory of measurements, exclusion principle, and electronic spin. Prerequisites: Physics 215 and 302. 3 units. *Thomas*

**317. Intermediate Quantum Theory.** General operator methods, angular momentum, Dirac electron theory. Second quantization; symmetry principles and conservation theorems. Applications to the theory of solids, of nuclei, and of elementary particles will be stressed. Prerequisite: Physics 316. 3 units. *Thomas*

**318-319. Electromagnetic Field Theory.** Electrodynamics, theory of wave optics, radiation of electric and magnetic multipole fields, special relativity, covariant electrodynamics, Lienard-Wiechert potentials, scattering and dispersion, Hamiltonian field equations. Prerequisite: Physics 182. 3 units each. *Biedenharn*

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\*Offered on demand.



**331. Quantum Electronics.\*** Electromagnetic radiation and its interaction with matter. Lasers, nonlinear optics, submillimeter waves, detection theory, propagation. 3 units. *De Lucia*

**333. Electronic Properties of Submicron Solid State Devices.** Doping, disordering, and grading in heterojunctions and superlattices. MOCVD and MBE growth techniques. Physical properties of submicron electronic devices, high speed transport, mobility, energy band structure, and scattering processes. Classical and quantum transport, quantum state transfer, control deformation of electron wave functions, mobility modulation, and phonon dynamics. Two-dimensional electron gases and plasmas. Monte Carlo simulation of submicron device performance. Current research and recent developments will be emphasized. C-L: Electrical Engineering 333. 3 units. *Stroschio*

**334. Atomic Physics and Spectroscopy.** The interaction of atoms and radiation: atomic structure. Spontaneous and stimulated transitions. Shapes of spectral lines. Radiative transfer. Population inversion. Laser oscillation. Resonant modes of optical cavities. Techniques of laser spectroscopy. 3 units. *Holmgren*

**335. Molecular Spectroscopy.** Interpretation and theory of electronic, vibrational, rotational, and nuclear hyperfine states. Bound state quantum mechanics. Emphasis on small fundamental species of importance in science and technology. 3 units. *De Lucia*

**341. Advanced Topics in Quantum Theory.** Introduction to relativistic quantum field theory, Lorentz and Poincaré groups, quantization of free fields, interacting fields and S-matrix, applications of quantum electrodynamics and dispersion relations. Prerequisite: Physics 317. 3 units. *Biedenharn*

**345. Advanced High Energy Physics.** Experimental and theoretical aspects of high energy nuclear processes; properties of mesons and hyperons. 3 units. *Staff*

**351, 352. Seminar.** A series of weekly discussions on topics related to the research projects under investigation in the department. Credit/no credit. *Staff*

## COURSES CURRENTLY UNSCHEDULED

214. Introduction to Solid-State Physics

306. Low Temperature Physics

310. Solid-State Physics II

312. Phase Transitions and Critical Phenomena

330. Nuclear Structure Theory

342. Theory of Elementary Particles

343. Nuclear Physics

344. Advanced Nuclear Physics

346. Topics in Theoretical Physics

397, 398. Low Temperature and Solid-State Seminar

## Political Science

Professor Kornberg, *Chairman* (214 Perkins); Associate Professor Lange, *Director of Graduate Studies* (331 Perkins); Professors Aldrich, Ascher, Barber, Bates, Braibanti, Fish, Holsti,

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\*Offered on demand.

Horowitz, Hough, Leach, Paletz, and Spragens; Associate Professors Eldridge, Johns, and McKean; Assistant Professors Bianco, Canon, Gillespie, Grant, Grieco, Kitschelt, Lomperis, Niou, Roberts, and Smith; Professors Emeriti Ball, Cleaveland, Cole, Grzybowski, Hall, Hallowell, Kulski, and Simpson; Adjunct Associate Professor O'Barr

The Department of Political Science offers graduate work leading to the A.M. and Ph.D. degrees. Before being admitted to candidacy for the Ph.D. degree, an applicant must have qualified for the A.M. degree.

Instruction is designed to prepare the student for teaching and research, for government service, and for other work related to public affairs. Before undertaking graduate study in political science, a student is ordinarily expected to have completed at least 12 semester hours of course work in political science. Instruction is currently offered in the following fields: American government and politics, comparative government and politics, political theory, and international relations.

The candidate for the degree of Doctor of Philosophy in political science must take at least sixteen courses in all, including twelve in the department, and demonstrate competence in at least two general fields of the discipline as well as in a third general field or in a specialized subfield or in a field external to the department. The candidate must also demonstrate a satisfactory knowledge of statistical techniques and/or one or more foreign languages.

The terminal degree of Master of Arts, for those who do not intend to continue with doctoral studies, is awarded following successful completion of: (1) eight one-semester courses of 3 units each, at least half of which must be in political science; and (2) either the A.M. thesis or two seminar-length research papers done for Duke courses with a grade of G+ or above (the student will be required to pass an oral exam with either of these options). In addition, candidates for the A.M. degree must demonstrate competence in one foreign language or in statistics.

Further details on the graduate program in political science, the departmental facilities, the staff, and available financial aid may be obtained from the Director of Graduate Studies, Department of Political Science.

### For Seniors and Graduates

**201S. Problems in International Security.** Major security issues. Prerequisite: a course in international relations or foreign policy. 3 units. *Staff*

**203S. Issues and Problems in Politics and the Media.** Research seminar analyzing significant questions in the relationship between politics and the media of communication. Prerequisite: consent of instructor. 3 units. *Paletz*

**204S. Ethics in Political Life.** Ethical issues arising in the conduct of political vocations and activities. C-L: Public Policy Studies 204S. 3 units. *Spragens*

**207S. American Constitutional Interpretation.** Development of the Constitution of the United States through Supreme Court decisions. 3 units. *Fish*

**208S. Analyzing the News.** See C-L: Public Policy Studies 240S. 3 units. *Staff*

**209. Problems in State Government and Politics.** 3 units. *Leach*

**211S. Current Problems and Issues in Japanese Politics.** Sources of strength and weakness in the Japanese economy, the rise of new issues and strains in postindustrial society, changes in the party system and decision-making process, the possible transfer of power, the challenge of Japan's new world role. 3 units. *McKean*

**212S. Domestic Structures and Foreign Policies of Advanced Democratic States.** The influence of democratic institutions on the national-security and foreign-economic policies of advanced industrialized states. 3 units. *Grieco*

**213S. Theories of International Political Economy.** Comparison and assessment of traditional and modern theories in terms of their logical and empirical validity. 3 units.

*Grieco*

**215S. Philosophical Bases of Political Economy and Society.** Central questions in the relationship between economy and society through an examination of the classical texts of political economy. Themes include: democracy and capitalism, the world economy and foreign policy, critiques of capitalism from the left and right. Readings drawn from Adam Smith, Karl Marx, J. M. Keynes, Joseph Schumpeter, Milton Friedman, and others. 3 units.

*Staff*

**216S. Evolution of European Marxism.** The central themes in the evolution of European Marxism: socialist thought prior to Marx; the writings of Marx and Engels. The themes are articulated in: Russian Marxism; Soviet communism and its Marxist critics; the rethinking of Marx's political economy, the theory of the state, and concepts of class consciousness in the works of twentieth-century European Marxists. 3 units. *Staff*

**218. Political Thought in the United States.** American political thought through the Civil War period. The Founders and their European antecedents. Debates over the Constitution, slavery, and the Union. 3 units. *Grant or Gillespie*

**220S. Problems in International Politics.** Prerequisite: one course on international relations or foreign policy or diplomatic history. 3 units. *Holsti or Hough*

**221S. International Institutions and the World Political Economy.** Examination of theory concerning the role of international institutions in facilitating economic cooperation among advanced democratic states. Investigation of the impact on international economic relations of such multilateral institutions as the International Monetary Fund, the World Bank, the General Agreement on Tariffs and Trade, and the International Energy Agency. 3 units. *Grieco*

**222S. Seminar: Modern Political Classics.** How social scientists think about politics. Works influential in shaping contemporary political science, written by political scientists, economists, and sociologists. Topics include democracy, capitalism, socialism, voting, and collective action. 3 units. *Staff*

**223. Ancient Political Philosophy.** Intensive analysis of the political philosophy of Plato, Aristotle, and other ancient theorists. 3 units. *Gillespie or Grant*

**224S. Modern Political Theory.** A historical survey and philosophical analysis of political theory from the beginning of the seventeenth to the middle of the nineteenth century. The rise of liberalism, the Age of Enlightenment, the romantic and conservative reaction, idealism, and utilitarianism. 3 units. *Grant or Spragens*

**225. Topics in Comparative Government and Politics: Western Europe.** Topics vary: the development of mass democracy and the welfare state; political and electoral participation and mobilization; social movements and political change; center-periphery conflicts; government and bureaucratic institutions and their relationships to society; the modern welfare state and political economy. 3 units. *Kitschelt or Lange*

**226S. Theories of International Relations.** An overview with applications to political-military and political-economic empirical problems. 3 units. *Grieco*

**228S. Nineteenth- and Twentieth-Century Political Philosophy.** Topics in nineteenth- and twentieth-century political philosophy, considering such authors as Hegel, Marx, Nietzsche, Dostoevski, Heidegger, Malraux, and Camus. 3 units. *Gillespie*

**229S. Contemporary Theory of Liberal Democracy.** Reading of major works and discussion of current issues in contemporary liberal and democratic theory. 3 units. *Spragens*



**230S. Introduction to Positive Political Theory.** Basic concepts of political economy, theory of preference and choice, social choice theory, and decision and game theory. 3 units. *Aldrich, Bates, or Bianco*

**231S. Crisis, Choice, and Change in Advanced Democratic States.** Contribution of Marx, Weber, and Durkheim toward analysis of modern democracies. Examination of selected contemporary studies using these three perspectives to highlight processes of change and crisis. Unsettling effects of markets upon political systems, consequences of bureaucratic regulation, and transformation of sources of solidarity and integration in modern politics. 3 units. *Kitschelt*

**232. Political Economy: Theory and Applications.** Selected topics. 3 units. *Lange*

**233S. Quantitative Political Analysis II.** Intermediate statistical methods, especially linear regression, for political science research. Emphasis on assumptions and interpretations of results. Prerequisite: Political Science 138 or 236 or equivalent. 3 units. *Staff*

**234S. Political Economy of Development: Theories of Change in the Third World.** Alternative approaches to political, economic, and social change in Latin America, Africa, and Asia. C-L: Cultural Anthropology 234S, History 234S, and Sociology 234S. 3 units. *Bates, Fox, Gereffi, Smith, or Trouillot*

**235S. Comparative Development of Islam.** Comparative development of Islam in Indonesia, Malaysia, Pakistan, India, North Africa, and sub-Saharan Africa. A comparative analysis of the resurgence of Islam as a religious, political, and cultural force. 3 units. *Braibanti*

**236. Statistical Analysis.** Introduction to statistics in political research, emphasizing research design, descriptive and inferential statistics, and use of computers. Not open to students who have had or who are enrolled in Political Science 138, Economics 138, Mathematics 53 or 117, Psychology 117, Public Policy Studies 112 or 122, or Sociology 132 or 293. 3 units. *Staff*

**237S. Comparative Public Policy.** Introduction to methods, concepts, and theories of comparative public policy analysis. Substantive policies examined in the course vary each semester and may include economic, industrial, social, and civil rights policies. 3 units. *Kitschelt*

**240. American Political Behavior.** 3 units. *Staff*

**242S. Comparative Law and Policy: Ethnic Group Relations.** Various approaches to the reduction of conflict in deeply divided societies, primarily in Asia and Africa, with secondary attention to Western countries. The nature of ethnic identity, the sources of group conflict, and the forms and patterns it takes. Methods of analyzing social science materials and utilizing them for the design of policies, laws, and institutions. 3 units. *Horowitz*

**243S. Political Applications of Game Theory.** Theory of games as a tool to understand strategic behavior of political actors. Applications to legislative politics, international cooperation, bureaucratic behavior. 3 units. *Bianco*

**245. Ethics and Policy-Making.** Not open to students who have taken Public Policy Studies 116. See C-L: Public Policy Studies 223. 3 units. *Rapaport*

**246S. Political Hypocrisy and Idealism.** The cases for and against hypocrisy in political and social life. The concept of authenticity as the alternative to hypocrisy. Selections from Machiavelli, Shakespeare, Rousseau, Nietzsche, and others. 3 units. *Grant*

**248. The Politics of the Policy Process.** See C-L: Public Policy Studies 219. 3 units. *Mayer*

**249. Comparative International Development and Technology Flow.** Theoretical analysis of social, political, and economic development in Third World countries. The internal problem of maintaining political systems and the external problem of adapting intermediate or appropriate technologies. 3 units. *Braibanti*

**251S. The American Presidency.** The presidency and its impact on the American political system. 3 units. *Paletz*

**253S. Comparative Government and the Study of Latin America.** Current literature on major themes of Latin American politics. 3 units. *Staff*

**255. Political Sociology.** See C-L: Sociology 255. 3 units. *Smith or Tiryakian*

**256S. Arms Control and National Security Policy.** The evolution of nuclear weapons and strategy and of global defense policy toward the Soviet Union and other adversaries; the arms control process and nonproliferation. Prerequisite: consent of instructor. 3 units. *Lomperis*

**259S. Low Intensity Conflict and the Lessons of Viet Nam.** The Viet Nam conflict and comparative cases; implications for Western interventions in the Third World. Prerequisite: consent of instructor. 3 units. *Lomperis*

**260S. The Tradition of Political Inquiry.** Past and present problems, goals, presuppositions, and methods. 3 units. *Spragens*

**261. Politics and the Future.** The projection of possible political orders: the effects of changing resources, technologies, and values on mankind's ability to govern. 3 units. *Lomperis*

**262S. International Communism.** 3 units. *Hough*

**263S. Methods of Political Science.** The relation between theory and evidence; research designs for the comparative analyses of historical and statistical evidence. 3 units. *Roberts*

**264S. Feminist Theory and the Social Sciences.** See C-L: History 284S; also C-L: Cultural Anthropology 284S, Psychology 284S, Sociology 284S, and Women's Studies. 3 units. *Chafe, Neuschel, O'Rand, C. Smith, or Spenner*

**267S. Policy-Making in International Organizations.** See C-L: Public Policy Studies 267S. 3 units. *Ascher*

**270S. Fundamentals of Political Economy.** Application of economic reasoning to the study of politics. Analysis of campaigns and elections, legislatures, and the regulation of industries. C-L: Economics 270S. 3 units. *Aldrich, Bates, or Bianco*

**275. The American Party System.** An intensive examination of selected facets of American national political parties, such as relationships between presidential and congressional politics, the politics of national conventions, recent foreign policy and party alignments, and the controversy over party government. 3 units. *Kornberg*

**277. Comparative Party Politics.** The impact of social and political systems on party structures, functions, ideologies, and leadership recruitment. Emphasis upon research techniques and objectives. 3 units. *Kornberg or Lange*

**279S. Political Protest and Collective Mobilization.** Survey of theories, methods, and empirical studies of political mobilization outside institutional channels; protest behavior and strategies; responses of the state to these challenges; the success of collective mobilization. Emphasis on comparative analyses of protest in advanced industrial democracies. 3 units. *Kitschelt*

**282S. Canada.** See C-L: History 282S; also C-L: Cultural Anthropology 282S and Sociology 282S. 3 units. *Cahow*

**283S. Congressional Policy-Making.** Lawmaking and oversight of the executive branch by the United States Congress. Committee, party, executive, and interest group roles. C-L: Public Policy Studies 283S. 3 units. *Bianco or Canon*

**284S. Public Policy Process in Developing Countries.** See C-L: Public Policy Studies 284S. 3 units. *Ascher*

**286S. Judicial Administration.** Organization, case processing, and management of courts with emphasis on federal appellate courts. Prerequisite: Political Science 127. 3 units. *Fish*

**293. Federalism.** Theoretical and operational aspects of federal systems of government, focusing on the United States and Canada. 3 units. *Leach*

**299. Special Topics in Government and Politics.** Topics vary from semester to semester. 3 units each. *Staff*

- A. American Government and Politics
- B. Comparative Government and Politics
- C. Political Theory
- D. International Relations

### For Graduates

**303. Seminar on Statistics.** Application of advanced statistical methods to political science research problems. Primary focus on multiple regression procedures. Emphasis on assumptions, interpretation of results, and use of the computer. Prerequisite: Political Science 236 or consent of instructor. 3 units. *Staff*

**305. Seminar in U.S. Foreign Policy.** Decision making in American foreign policy. The sources, substance, and consequences of U.S. policy will be examined. The emphasis is on the period since 1945. 3 units. *Holsti*

**306. Political Development of the U.S. Fourth Circuit Courts.** A research seminar on federal trial and appellate courts, judges, and law: Maryland, Virginia, West Virginia, North and South Carolina, 1789-1958. 3 units. *Fish*

**308. Individual Research.** Students will conduct research designed to evaluate hypotheses of their choice. Reports on the research must be presented in appropriate professional style. 3 units. *Staff*

**309. Seminar in International Relations.** Critical survey of theories and research in international relations and foreign policy. Emphasis will be placed on the interrelation between theory and research. 3 units. *Holsti*

**321. Seminar in Political Theory.** Prerequisites: 6 units in political science elected from 223, 224, 229, 231, or their equivalents. 3 units. *Staff*

**322. Topics in Early Modern Political Thought.** Selected readings from political thinkers ranging from Machiavelli to Mill. 3 units. *Grant or Spragens*

**324. Seminar in Comparative Politics (A).** A field survey with emphasis on the politics of developing areas. Note: it is generally expected that political science graduate students taking comparative politics as a preliminary field will take both this course and Political Science 325. 3 units. *Staff*

**325. Seminar in Comparative Politics (B).** A field survey with emphasis on the politics of advanced industrial democracies. Note: it is generally expected that political science graduate students taking comparative politics as a preliminary field will take both this course and Political Science 324. 3 units. *Staff*



**326. Research Seminar in Comparative Government and Politics.** Seminar in major issues in comparative politics and intensive individual student research projects. 3 units. *Staff*

**327. Comparative Political Behavior (B).** This seminar critically examines research on variations in elite and mass behavior as well as the conditions affecting that behavior in a variety of western countries. 3 units. *Kornberg*

**332. Seminar on Political Economy: Micro Level.** Survey of recent work in political science and economics on the organization of institutions: political, sociological, and economic. Focus upon the ways in which rational choice theory is applied to areas outside of economics. 3 units. *Bates*

**333. Seminar in Political Economy: Macro Level.** Survey and analysis of recent work in political science, economics, and sociology on the relationships between states and markets. Special emphasis on the ways states influence market outcomes and the ways the organization of power in markets influences state behavior, especially in democratic systems. 3 units. *Lange*

**340. Seminar in American Politics and Institutions.** Survey, analysis, and critique of the literature. 3 units. *Paletz or staff*

**381. Research Seminar in Latin American Government and Politics.** Prerequisite: Political Science 253 or equivalent. 3 units. *Staff*

**390. Research Seminar in International Relations.** Prerequisite: Political Science 226, Political Science 309 or equivalent. 3 units. *Holsti*

**397. Selected Topics in Government and Politics.** Topics vary from semester to semester. 2 units. *Staff*

**398. Selected Topics in Government and Politics.** Topics vary from semester to semester. 3 units. *Staff*

#### COURSES CURRENTLY UNSCHEDULED

**214S. The Politics of Scarcity**

**280S. Comparative Government and Politics: Sub-Saharan Africa**

**360. Seminar in Government and Politics in the Soviet Union**

#### RELATED COURSE WORK IN THE SCHOOL OF LAW

There may be graduate credit for course work completed in the Duke University School of Law, under regulations referred to in this bulletin under the section on academic regulations.

## Psychology

Professor R. Erickson, *Chairman* (224 Psychology-Sociology); Professor Hasher, *Director of Graduate Studies* (305 Psychology-Sociology); Professors Alexander, Carson, Coie, Costanzo, Diamond, C. Erickson, W. G. Hall, Lakin, Lockhead, Rubin, Staddon, M. Wallach, and Wing; Associate Professors Day, Eckerman, and Roth; Assistant Professors Kremen and Putallaz; Professors Emeriti Borstelmann, Kimble, and H. Schiffman; Adjunct Professors Brodie, Crovitz, W. C. Hall, S. Schiffman, Thompson, L. Wallach, and Weiss; Adjunct Associate Professor Marsh; Adjunct Assistant Professor Lochman

The department offers graduate work leading to the Ph.D. degree. The areas of concentration are cognitive and sensory sciences, behavioral neurosciences, human develop-

ment, and clinical-personality. A brochure is available from the Director of Graduate Studies which describes the program in more detail and gives information on financial assistance, facilities, and current research activities. The psychology department has no foreign language requirement.

### For Seniors and Graduates

**200. Advanced Neuroscience I.** Basic neuroanatomy and neurophysiology, physiology of the neuron and neural networks, neurotransmitter functions, sensory and motor systems. Fall semester. C-L: Zoology 200. 3 units (4 with laboratory). *Cant and McClay*

**201. Advanced Neuroscience II.** Integrative activities of the nervous system: sensory-motor relationships, neuroendocrine relationships, emotion and motivation, sleep, learning and memory, diseases of the nervous system and their psychological correlates. Spring semester. Prerequisite: Psychology 200. 3 units (4 with laboratory). *R. Erickson and W. G. Hall*

**203S. Sensation and Perception.** Classical and current concepts and methods. 3 units. *Lockhead*

**204S. Great Ideas in Psychology.** Ideas in psychology drawn from various areas (perception, personality, motivation, biological bases, social, cognitive, developmental, learning, clinical) and various methodological approaches (experimental, introspection, observation, interview, longitudinal, simulation). 3 units. *Day*

**207S. Topics in Psychobiology.** The biological substrates of human behavior in health and disease. Drug abuse, alcoholism, depression, schizophrenia, and human aggression. Films and videotapes. Student presentations; patient interviews. 3 units. *Brodie*

**210S. Cognition.** Schematic view of cognitive psychology plus intensive study of two to three specific research topics such as forms of representation, individual differences, and problem-solving models. Emphasis on alternative experimental and theoretical approaches. Prerequisite: Psychology 107 or graduate status. 3 units. *Day*

**212S. Human Memory.** Classical and modern literature, data, and theories relating to mechanisms of information processing, storage, and retrieval. 3 units. *Hasher or Rubin*

**214S. Development of Social Interaction.** Major concepts and methods pertaining to early social development, emphasizing human social behavior and a developmental psychobiological approach. 3 units. *Eckerman*

**215S. Cognitive Development.** Major approaches to the development of knowledge, including Piaget, Thomas Kuhn, Vygotsky, Eleanor Gibson, Kohlberg, and others. 3 units. *L. Wallach*

**217S. Advanced Social Psychology.** The psychology of interpersonal influence and control; the cognitive and social factors affecting the perception of persons and social action; the dynamics of interpersonal relations and relationship formation and change; the contribution of individual differences to social behavior. Applications in environmental psychology, social psychology and law, and organizational psychology. 3 units. *Costanzo*

**219S. Physiological Foundations of Psychology.** Structure and function of the nervous system as related to problems of sensory-motor processes, learning, motivation, and memory. 3 units. *C. Erickson and R. Erickson*

**220S. Psycholinguistics.** Selected topics such as neurolinguistics, linguistic versus pictorial representation, individual differences, oral vs. written expression, language and personality, and the language-thought interaction. Prerequisite: Psychology 134 or graduate status. 3 units. *Day*





**234S. Advanced Personality.** Selected topics of current interest concerning empirical research on personality. Strategies for the definition of research questions and the evaluation of research progress. Prerequisite: consent of instructor. 3 units. *M. Wallach*

**238S. Psychophysiology.** How emotional and cognitive processes are expressed physiologically and recorded from heart, skin, muscle, and brain activity. Discussion of major research papers in the field; focus on outlining what is known and developing an understanding of the major issues in psychophysiology. Topics include: sleep, selective attention, memory, language processes, lie detection, and differentiation between arousal, anger, and fear. Laboratory. 3 units. *Marsh*

**266S. Comparative Neurobiology.** The evolution and functional organization of the vertebrate brain. A study of the original papers of the pioneers in comparative anatomy. Prerequisite: consent of instructor or graduate status. 3 units. *Diamond and W. C. Hall*

**267S. Brain Mechanisms of Behavior.** General physiological principles of brain organization in relation to behavioral processes from sensation to concept formation. Discussions of original readings from seminal papers in the early nineteenth century to the present. Prerequisite: consent of instructor or graduate status. 3 units. *R. Erickson*

**270S. A-R, U-Z. Selected Problems.** New courses not yet in the bulletin are designated as 170S or 270S depending on level. Since all faculty offer these courses, their contents vary accordingly. Different courses indicated by the letter. 3 units. *Staff*

**273S. Statistical Principles in Experimental Design.** The problems of scientific inference; methods of data analysis and issues in experimental design. 3 units. *Roth or staff*

**284S. Feminist Theory and the Social Sciences.** See C-L: History 284S; also C-L: Cultural Anthropology 284S, Political Science 264S, Sociology 284S, and Women's Studies. 3 units. *Chafe, Neuschel, O'Rand, C. Smith, or Spenner*

**289S. Psychology of Prevention.** Concepts of prevention and mental health promotion; community psychology and social systems; epidemiology and prediction of disorder; intervention strategies; evaluation of prevention trials; and ethical and cultural issues. 3 units. *Coie*

#### **For Graduates**

**301. Group Psychotherapy and Group Influence Processes.** Theories of group interventions and group techniques. 3 units. *Lakin*

**302. Personality Theory.** An advanced course in the representative theories of human functioning, from Freud to contemporary approaches. 3 units. *Staff*

**305. Psychopathology.** An examination of behavior disorders, with particular emphasis on explanatory concepts and the evidence from research in this field. 3 units. *Carson*

**307. Introduction to Theories and Methods of Mainstream Psychotherapies.** Application of personality theories to therapeutic change processes. Problems of therapy case management. 3 units. *Carson or Lakin*

**309. Seminar in Learning.** Selected topics in operant conditioning and discrimination learning. 3 units. *Staddon*

**310. Seminar in Perception.** 3 units. *Lockhead*

**318. Measurement and Methods.** Examination of relationships among ideas, methods, and measures in psychological and social research. 3 units. *Staff*

**329-330. Proseminar in Psychology.** A historically oriented, team-taught course introducing graduate students to important ideas and discoveries in scientific psychology. 6 units. *Staff*

**335-336. Personality Assessment.** First semester: personality assessment through interviews and the study of personal documents. Second semester: personality assessment through the study of formal tests, objective and projective. 6 units. *Alexander*

**338. Ethics for Psychologists.** A course for graduate students in all the areas of psychology. 3 units. *Lakin*

**339. Ethics for Psychotherapists.** A course for graduate students in the clinical program. 3 units. *Lakin*

**343-344. Clinical Practicum.** Intensive experience and supervision in clinical intervention processes. Student training in psychotherapy strategies and techniques and in clinical consultation skills is conducted in clinical settings. 6 units. *Staff*

**348. Psychotherapy with Children and Families.** Major theoretical approaches to clinical intervention with children and adolescents, either individually or in the family system context. 3 units. *Coie*

**349-350. Practicum in Psychological Research.** 6 units. *Staff*

**351. Developmental Psychopathology.** Consideration of major psychopathological disorders in childhood and adolescence, theories and research on etiology and prediction of disorder. 3 units. *Lochman and Thompson*

**398. Graded Research.** 1 to 3 units. *Staff*

**399. Special Readings in Psychology.** 3 units. *Staff*

## COURSES CURRENTLY UNSCHEDULED

**206S. Stress and Health**

**230S. Social Behavior of Animals**

**231S. Parent-Child Interaction**

**255S. Perinatal Behavior**

**286S. Biological Basis of Hearing**

**323, 324. Seminar in Community Psychology**

**337. Seminar in Sensory Discrimination**

**352. Child Assessment**

**353. Research Practicum in Prevention**

## Public Policy Studies

Professor Cook, *Director* (109C Old Chemistry); Professor Ladd, *Director of Graduate Studies* (112 Old Chemistry); Professors Ascher, Barber (political science), Behn, Clotfelter, Eddy, Fleishman (School of Law), Gillis, Horowitz (School of Law), Hough (political science), Kuniholm, Pearsall (engineering), and Price (political science); Associate Professors Conrad, Lipscomb, Magat (Fuqua School of Business), McConahay, Rapaport, and Stack; Assistant Professors Durning, Malson, Mayer, and Smith; Professors of the Practice Geller, Stubbing, and Yaggy; Lecturer Payne; Visiting Professor Healy (School of Forestry and Environmental Studies)

The graduate program in public policy studies is offered through the Institute of Policy Sciences and Public Affairs. The objective of the program is to prepare students for jobs, particularly in the public sector, which require analytical skills and a practical understanding of the processes by which policy is made and implemented.

The A.M. degree requires two academic years and a summer internship. The first year is devoted to core courses in policy analysis, including sequences in quantitative methods, economics, political analysis, and ethics. The summer internship is arranged with a federal, state, or local agency. The second-year curriculum includes course work in public management and macroeconomics, a concentration in a substantive policy area, and a master's "memo" to be researched and written on a problem of current policy concern.

Students who are concurrently enrolled in a Ph.D. program or a professional degree program (M.D., J.D., M.B.A., M.H.A., etc.), or who have already obtained such a degree, can apply for an abbreviated version of the A.M. program. Such students are excused from most second-year requirements, so ordinarily the A.M. in public policy can be completed in one additional year. Students usually apply for a joint degree program simultaneously with their applications to the graduate departments or professional schools, or during their first or second year of advanced study.

The institute does not award a Ph.D.

More information concerning the A.M. programs can be obtained by writing the Director of Graduate Studies.

### For Seniors and Graduates

**204S. Ethics in Political Life.** See C-L: Political Science 204S. 3 units. *Spragens*

**217. Microeconomics and Public Policy-Making.** Consumption and production theory, welfare economics, theories of collective choice, market structures and regulation, and nonmarket decision making. (Not open to students who have taken Public Policy Studies 110.) 3 units. *Clotfelter*

**218. Macroeconomic Policy.** Survey of macroeconomic theory and analysis of policies designed to reduce unemployment, stimulate economic growth, and stabilize prices. Conventional monetary and fiscal instruments, employment policies, and new policies designed to combat inflation. C-L: Economics 218. 3 units. *Staff*

**219. The Politics of the Policy Process.** The formulation of public policies, substantive policies in a variety of contexts from local government to international affairs; the role of legislatures, interest groups, chief executives, and the bureaucracy in defining alternatives and in shaping policy from agenda formulation to implementation. (Not open to students who have taken Public Policy Studies 114.) C-L: Political Science 248. 3 units. *Mayer*

**221. Decision Analysis for Public Policymakers.** Methods for structuring decision dilemmas and decomposing complex problems, assessing the probabilities of uncertain consequences of alternative decisions, appraising the decision maker's preferences for these consequences and for re-examining the decision. (Not open to students who have taken Public Policy Studies 55.) 3 units. *Behn*

**222. Data Analysis for Public Policymakers.** Sampling theory, Bayesian statistics, and regression analysis. Examples from problems in health care, transportation, crime, urban affairs, and politics. (Not open to students who have taken Public Policy Studies 112.) 3 units. *McConahay*

**223. Ethics and Policy-Making.** Normative concepts in politics, liberty, justice, the public interest: historical and philosophical roots, relationship to one another and to American political tradition, and implications for domestic policy problems. Not open to students who have taken Public Policy Studies 116. C-L: Political Science 245. 3 units. *Rapaport*



**231. Quantitative Evaluation Methods.** Problems in quantifying policy target variables such as unemployment, crime, and poverty. Experimental and nonexperimental methods for evaluating the effect of public programs, including topics in experimental design, regression analysis, and simulation. Prerequisite: Public Policy Studies 222 or equivalent. 3 units. *Cook or McConahay*

**232. Microeconomics: Policy Applications.** Cost benefit analysis of public programs. Public utility regulation, pollution regulation, hospital rate setting, regulation of product safety. Quantitative methods and microeconomic theory for analysis of both normative and positive aspects of economic policy. Prerequisites: Public Policy Studies 110 or 217 or Economics 149 and familiarity with regression analysis or concurrent enrollment in Public Policy Studies 231. C-L: Economics 232. 3 units. *Ladd*

**236S, 237S. Public Management I and II: Managing Public Agencies.** 236S: operations management, information and performance, personnel management, public sector marketing. 237S: organizational strategy, organizational structure and design, leadership and motivation, labor negotiations. Prerequisite for 237S: Public Policy Studies 236S. 3 units each. *Behn or Yaggy*

**238S. Public Budgeting and Financial Management.** Fund accounting for government; techniques of financial analysis, including break-even analysis, cost accounting, cash-flow analysis, and capital budgeting; and governmental budgeting, including the budgetary process and reforms, and the budget crunch in the public sector. 3 units. *Stubbing*

**240S. Analyzing the News.** Research seminar on political messages and effects of media. Methods and findings of content analysis, survey research, critical theory, semiology; research project integrating these approaches. C-L: Political Science 208S. 3 units. *Staff*

**241. Reporting the American People.** Critical analysis of the sources of information the media rely upon in reporting opinion and policy preferences: opinion polls, bellwethers, informed elites. Includes the design and execution of a public opinion poll on a topic of local or national interest. 3 units. *McConahay*

**245S. Leadership Tutorial.** Analysis of techniques, personal qualities, and organizational factors that help or hinder effective leadership. Practical experience in evaluation of leadership efforts. Prerequisite: Public Policy Studies 145D or consent of instructor. 3 units. *Payne*

**250S. Policy, Philanthropy, and the Arts.** Democratic and aesthetic values in relation to past and present patterns of public, corporate, and philanthropic support for the arts. The uses of art criticism and political theory in evaluating subsidies, grants, tax incentives, and censorship. Prerequisite: consent of instructor. 3 units. *Payne*

**254. Transportation Planning and Policy Analysis.** Prerequisite or corequisite: Civil and Environmental Engineering 116 or consent of instructor. See C-L: Civil and Environmental Engineering 216. 3 units. *Pas*

**257. United States Policy in the Middle East.** From World War II to the present with a focus on current policy options. 3 units. *Kuniholm*

**264S. Research Seminar: Topics in Public Policy I.** Selected topics. 3 units. *Staff*

**267S. Policy-Making in International Organizations.** Emphasis on international financial institutions such as the World Bank and the International Monetary Fund. C-L: Political Science 267S. 3 units. *Ascher*

**268. Federal Tax Policy.** Structure, incidence, and economic effects of major federal taxes. Special attention to problems of inflation, income definition, distortions, savings, and investment. C-L: Economics 268. 3 units. *Clotfelter or Schmalbeck*

**270S. Humanistic Perspectives on Public Policy.** Modes of inquiry into aspects of social life important to policymakers but beyond the normal reach of social science. Reading from James Agee, Robert Coles, Eudora Welty, James Baldwin, George Eliot, and others. Prerequisite: consent of instructor. 3 units. *Coles and Payne*

**272. Resource Economics and Policy.** See C-L: Forestry and Environmental Studies 270. 4 units. *Kramer*

**278. Human Service Bureaucracies.** Schools, prisons, courts, welfare agencies: decision making, implementation, the impact of work practices on clients. The future of street-level bureaucracy. 3 units. *Malson*

**283S. Congressional Policy-Making.** See C-L: Political Science 283S. 3 units. *Bianco or Canon*

**284S. Public Policy Process in Developing Countries.** Policy-making patterns in less developed countries; examples from Latin America, Africa, and Asia. C-L: Political Science 284S. 3 units. *Ascher*

**286S. Economic Policy-Making in Developing Countries.** Fiscal, monetary, and exchange rate policies in less developed countries; issues in public policy toward natural resources and state-owned enterprises. Prerequisite: Public Policy Studies 110 or Economics 149. C-L: Economics 286S. 3 units. *Conrad or Gillis*

### For Graduates

**303. Public Policy Workshop I.** Introduction to policy analysis and advising. Emphasis on written and oral communication skills, the substance of public policies, and the role of policy analysts. Open to Public Policy Studies A.M. students only. 3 units. *Durning*

**304.01. Public Policy Workshop II.** The role and influence of policy analysis. The examination of specific public policy cases and recommendations for action. Emphasis on written and oral communications skills. 3 units. *Durning*

**305.01. Public Policy Workshop III.** Emphasis on individual or group projects. Preparation for Master's Memo. Open to Public Policy Studies A.M. students only. 3 units. *Yaggy*

**325S, 326S. Program in International Development Policy Sector Seminar.** Exploration of the relationships among sectoral policies and sustainable development in less developed countries, with emphasis on a particular sector each year. Open only to Program in International Development Policy Fellows, or by consent of instructor. Variable credit. *Staff*

**327, 328. Program in International Development Policy Issue Seminar.** Topics in the policy issues and institutional structures of sectoral policy-making in less developed countries. Open only to Program in International Development Policy Fellows, or by consent of instructor. Variable credit. *Staff*

**388. Research Tutorial in Public Policy.** 3 units. *Staff*

**399. Special Readings in Public Policy Studies.** 3 units. *Staff*

### COURSES CURRENTLY UNSCHEDULED

**256. The Economics of Health Care**

**270S. Humanistic Perspectives on Public Policy**

## Religion

Professor Hillerbrand, *Chairman* (123A Gray); Professor Hauerwas, *Director of Graduate Studies* (209A Divinity School); Professors D. Campbell, Clark, Crenshaw, Herzog, Kort,

Langford, Lawrence, Lincoln, Marsden, E. Meyers, Osborn, D. M. Smith, H. Smith, Steinmetz, Via, Wainwright, and Wintermute; Associate Professors Bailey, Bland, Corless, C. Meyers, Partin, Peters, and Surin; Assistant Professors Berger, T. Campbell, Fulker-son, Keefe, Martin, Robinson, and Turner; Research Professor Richey

The Department of Religion offers graduate work leading to the A.M. and Ph.D. degrees. Students may major in one of seven fields: (1) Hebrew Bible and Semitics, (2) New Testament and Christian origins, (3) history of Christianity, (4) Christian theology and ethics, (5) history of Judaism, (6) history of religions, and (7) religion and culture. They will be expected to take courses which will contribute to an adequate understanding of their chosen fields of specialization and will be required to take two written preliminary examinations within their field of concentration.

In addition to course work in their major field, students will take such other courses in cognate fields as will contribute to the enrichment of their major studies and will be required to take one written preliminary examination in a single cognate area within the department. A minor requirement may be fulfilled by work in a cognate department, such as classical studies, history, philosophy, political science, or sociology, and will constitute the outside minor and material for a fourth written preliminary examination. There is, in addition, an oral examination conducted by the student's committee immediately subsequent to the written examinations. There is a foreign language requirement of two languages which must be met before taking the doctoral preliminary examination.

The program of doctoral studies presumes a foundation in the academic study of religion. Students applying for graduate work in religion directly from an undergraduate program should have had a strong undergraduate major in religion, and will be accepted for the Ph.D. program only upon the satisfactory completion of the A.M. degree with the department.

The graduate program also offers an A.M. degree that is not linked to a specific Ph.D. field. Such study is intended to encourage individuals to pursue a variety of interests irrespective of whether they desire further graduate study. An A.M. concentration may be in any of the seven Ph.D. fields or in an individually designed program of study (such as Islamic studies or religion and the social sciences).

#### For Seniors and Graduates

**200. Person and Work of Christ.** The problem of knowledge of Christ and formulation of a doctrine of his work and person in the light of biblical eschatology. 3 units. *Staff*

**203. Studies in American Methodism.** Research seminar devoted to selected topics in the Wesleyan and Methodist traditions in America. 3 units. *Richey*

**205. War and the Christian Tradition.** An analysis of how Christians have understood and evaluated war, with particular attention to the question of the moral status of war. Works by Augustine, Aquinas, Bainton, Ramsey, Childress, Niebuhr, and Johnson will be considered. 3 units. *Hauerwas*

**207, 208. Intermediate Biblical Hebrew.** Grammar with reading and exegesis of Old Testament prose and poetry. Prerequisite: at least one year of Hebrew or consent of instructor. C-L: Old Testament 207, 208 in the Divinity School. 6 units. *Staff*

**210. Contemporary British Theology.** Selected problems in representative British theological writings after 1900. 3 units. *Langford*

**211. Authority in Theology.** The idea and function of authority in theology. 3 units. *Fulkerson*

**213. Christian Ethics in America.** Ethical thought in America since Rauschenbush. 3 units. *Hauerwas*



- 214. Feminist Theology.** Examination of feminist theologians and religionists, their critical perspective on the Christian tradition and constructive proposals out of the resources of "female experience." 3 units. *Fulkerson*
- 215S. Theological Ethics.** Philosophical paradigms and the nature of the Christian life. 3 units. *Hauerwas*
- 217. Islam in India.** History and thought of major Indian Muslims from Biruni to Wali-Ullah, with special attention to the role of Sufism. An introduction to selected Muslim scholars and saints who contributed to the interaction between Islam and Hinduism in northern India during the second millennium A.D. 3 units. *Lawrence*
- 218. Religions of East Asia.** Shinto, Taoism, Confucianism, and East Asian Buddhism studied phenomenologically in relation to the Axial Age. 3 units. *Corless*
- 219. Augustine.** The religion of the Bishop of Hippo in late antiquity. C-L: Medieval and Renaissance Studies. 3 units. *Clark*
- 220. Rabbinic Hebrew.** Interpretive study of late Hebrew, with readings from the Mishnah and Jewish liturgy. 3 units. *E. Meyers or staff*
- 221. Readings in Hebrew Biblical Commentaries.** Selected Hebrew texts in Midrash Aggadah and other Hebrew commentaries reflecting major trends of classical Jewish exegesis. 3 units. *Bland or staff*
- 222. John among the Gospels.** A consideration of the character, content, and purpose of the Gospel of John in relation to the synoptic and apocryphal gospels. Prerequisite: one year of Hellenistic Greek. 3 units. *M. Smith*
- 223A-E. Exegesis of the Hebrew Old Testament.** 3 units each.
- A. Pentateuch. *Staff*
  - B. Historical Books. *Staff*
  - C. Major Prophets. *Staff*
  - D. Minor Prophets. *Staff*
  - E. Writings. *Staff*
- 225. Living Issues in New Testament Theology.** Critical examination of major problems and issues in New Testament interpretation and theology. 3 units. *Via*
- 226A-F. Exegesis of the Greek New Testament I.** 3 units each.
- A. Matthew. *Via*
  - B. Romans. *Staff*
  - C. Mark. *Via*
  - E. The Gospel and Epistles of John. *D. M. Smith*
  - F. I and II Corinthians. *D. M. Smith*
- 227A-E. Exegesis of the Greek New Testament II.** 3 units each.
- A. Luke. *Staff*
  - B. Galatians. *D. M. Smith*
  - C. The Pastoral Epistles. *Staff*
  - D. Epistles of Peter and James. *Staff*
  - E. Acts. *M. Smith*
- 228. Twentieth-Century Continental Theology.** An investigation of leading theologians and theological trends. 3 units. *Osborn*
- 230S. The Meaning of Religious Language.** An analysis of the credentials of some typical claims of theism in the light of theories of meaning in recent thought. C-L: Philosophy 230S. 3 units. *Staff*
- 232S. Religion and Literature.** Theories concerning the relation of religion to literary forms, particularly narrative. 3 units. *Kort*

- 233. Modern Narratives and Religious Meanings.** A study of kinds of religious meaning or significance in representative American, British, and Continental fiction of the first half of the twentieth century. 3 units. *Kort*
- 234. Early Christian Asceticism.** The development of asceticism and monasticism in the first six centuries of Christianity. C-L: Women's Studies. 3 units. *Clark*
- 235. Heresy: Theological and Social Dimensions of Early Christian Dissent.** 3 units. *Clark*
- 236. Luther and the Reformation in Germany.** The theology of Martin Luther in the context of competing visions of reform. C-L: Medieval and Renaissance Studies. 3 units. *Steinmetz*
- 237. History of the Ancient Near East.** Emphasis upon the religions, literature, and art of Mesopotamia. 3 units. *Bailey*
- 238. Jewish Responses to Christianity.** Apologetic and polemical themes in rabbinic, medieval, and contemporary writings. 3 units. *Bland*
- 239. Introduction to Middle Egyptian I.** Grammar and readings in hieroglyphic texts relating to the Old Testament. 3 units. *Wintermute*
- 240. Introduction to Middle Egyptian II.** Readings in Middle Egyptian and introduction to New Egyptian Grammar. Prerequisite: Religion 239. 3 units. *Wintermute*
- 242. Life after Death in Semitic Thought.** Consideration of the various ideas from the early second millennium through the intertestamental period. Exegesis of selected Old Testament passages. Evaluation of recent research. Knowledge of Hebrew helpful but not required. 3 units. *Bailey*
- 243. Archaeology of Palestine in Biblical Times.** Investigation of selected material remains from the Bronze Age to the Persian period. Trends in biblical studies, with particular attention to methodological considerations and current developments. 3 units. *C. Meyers*
- 244. The Archaeology of Palestine in Hellenistic-Roman Times.** The study of material and epigraphic remains as they relate to Judaism in Hellenistic-Roman times, with special emphasis on Jewish art. 3 units. *E. Meyers*
- 246. Problems in Historical Theology.** Prerequisite: consent of instructor. 3 units. *Staff*
- 247. Readings in Latin Ecclesiastical Literature.** Readings in Latin of pastoral, theological, and church-disciplinary literature from the late patristic and medieval period. Prerequisite: knowledge of Latin. 3 units. *Keefe*
- 248. The Theology of Karl Barth.** A historical and critical study of the theology of Karl Barth. Prerequisite: consent of instructor. 3 units. *Osborn*
- 250. Women in the Medieval Church.** The history of the medieval church told from its women figures: the life and writings of saints, heretics, abbesses, queens, mystics, recluses, virgins, bishops' wives, and reformers. 3 units. *Keefe*
- 257. New Testament Ethics.** Scope and basic problems of New Testament ethics; consideration of two important New Testament books. Problems and issues such as the role of the law, symbolic language in ethical discourse, conscience, homosexuality, the state, and self deception. 3 units. *Via*
- 258. Coptic.** Introduction to the Sahidic dialect with selected readings from Christian and Gnostic texts. Prerequisite: at least one year of Greek. 3 units. *Wintermute*

**260. Life and Thought of the Wesleys.** A seminar on John and Charles Wesley and their colleagues in relation to English culture and religion in the eighteenth century. 3 units. *T. Campbell*

**264. The Sociology of the Black Church.** An effort to identify, define, describe, and interpret the black church. 3 units. *Lincoln*

**265. The Religions of the West Africa Diaspora.** Religious development of Africans displaced to the Western Hemisphere by slavery. 3 units. *Lincoln*

**266. Ethics and Health Care.** 3 units. *H. Smith*

**267. American Puritan Thought through Edwards.** Study of some of the classic investigations of American Puritan thought, culminating with a more intensive look at literature by and about Jonathan Edwards. 3 units. *Marsden*

**268. Revelation and Authority in the Church.** A critical and constructive examination of contemporary concepts. 3 units. *H. Smith*

**269. Feminist Theory and the Humanities.** C-L: English 283 and Women's Studies. 3 units. *Clark, Orr, Pope, or Tompkins*

**270. American Evangelicalism and Fundamentalism.** A study of some of the major themes in the development of transdenominational evangelicalism and fundamentalism in America from the eighteenth century to the present. This will be a reading seminar involving analyses and discussions of literature (mostly secondary works) important for understanding American evangelicalism as a distinct movement. 3 units. *Marsden*

**272. The Early Medieval Church: Gregory of Tours; Isidore of Seville; Bede.** A social history of the church in France, Spain, and England from the sixth to the eighth centuries studied through the writings of Gregory of Tours, Isidore of Seville, and Bede. Prerequisite: knowledge of Latin. 3 units. *Keefe*

**273. Continental and British Roots of Evangelicalism.** This course will introduce a range of religious phenomena in Europe and Britain in the late seventeenth and eighteenth centuries characterized by a stress on personal religious experience. Movements studied will include Jansenism, quietism, radical movements of the English Revolution, pietistic puritanism, precisianism, reformed and Lutheran pietism, and the evangelical revival in Wales and England. 3 units. *T. Campbell*

**276. Baptism in the Patristic and Early Medieval Period.** A study of the celebration and interpretation of the rite of Christian initiation in the church orders, catechetical sermons and liturgical commentaries of the first five centuries and in the service books and legislative and pastoral texts of the early church writers. 3 units. *Keefe*

**279. Understandings of the Resurrection in Contemporary Thought.** Recent literature on the resurrection of Jesus Christ from the perspectives of exegesis, historical criticism, hermeneutics, and systematic significance. 3 units. *Wainwright*

**280. The History of the History of Religions.** The origin and history of the comparative study of religion, with particular attention to its methodology. 3 units. *Partin*

**282. Myth and Ritual.** Myths, rites, and symbols as modes of religious expression. Interpretation of symbolic configurations of kingship, initiation, sacrifice, and pilgrimage in diverse cultural contexts. 3 units. *Robinson and staff*

**283. Islam and Modernism.** Cultural, religious, and ideological forces which shape Muslim responses to modernism. 3 units. *Lawrence*

**285. Introduction to the History of Religions.** The history, symbols, rites, and structures of the manifestations of the sacred in the major religious traditions of the world. 3 units. *Staff*



287. **The Scriptures of Asia.** Translations of basic texts from the religious traditions of India, China, and Japan. 3 units. *Staff*

292. **Happiness, Virtue, and Friendship.** Issues of their relationship in moral philosophy. 3 units. *Hauerwas*

293. **Religious Issues in American History.** A reading seminar devoted to selected topics, problems, and issues in American religion. 3 units. *Richey*

295. **Religion in the American South.** A study of the interrelationships of Southern religion and Southern culture. 3 units. *Marsden*

297. **Philosophical and Theological Discourses on Modernity.** Theological responses to the intellectual and cultural agendas set by the Enlightenment. 3 units. *Surin*

298. **Religious Pluralism and Christian Theologies.** The ascription of superiority or uniqueness to particular religions within the context of the world religions. The phenomenon of religious pluralism will provide a thematic focus for this study. 3 units. *Surin*

299. **The Christian Understanding of Human Nature and Destiny.** Representative historical and recent theological interpretations of human nature, predicament, deliverance, and possibility. 3 units. *Langford*

#### For Graduates

300. **Systematic Theology.** Method and structure of systematic theology, the doctrine of God, theological anthropology, and Christology. 3 units. *Herzog*

302. **Studies in the Intertestamental Literature.** Selected documents of the Apocrypha and Pseudepigrapha examined exegetically and theologically in their relation to postexilic Judaism. Prerequisite: consent of instructor. 3 units. *Staff*

304. **Aramaic.** A study of the Aramaic portions of the Old Testament and selected passages from the Elephantine and Qumran texts. 3 units. *E. Meyers or Wintermute*

305. **The Septuagint.** A study of the modern critical use of the Greek Old Testament. Prerequisites: knowledge of Greek and Hebrew. 3 units. *Peters*

306. **Language and Literature of the Dead Sea Scrolls.** A study in interpretation. Prerequisite: a knowledge of Hebrew. 3 units. *Staff*

307. **Syriac.** A study of the script and grammar, with readings from the Syriac New Testament and other early Christian documents. Prerequisite: some knowledge of Hebrew and Aramaic. 3 units. *Staff*

309. **Hermeneutics.** Consideration of the nature of understanding and of several interpretive methods—such as phenomenological, existential, historical, literary, structural—along with their application to New Testament texts, primarily the parables of Jesus. 3 units. *Via*

310. **Readings in Judaica.** Selected studies in Jewish material culture and problems in Jewish religious and intellectual history. 3 units. *Bland, E. Meyers, and staff*

316S. **History of Religions.** Selected problems in the field. 3 units. *Staff*

322. **Nineteenth-Century European Theology.** Protestant theology from Kant to Herrmann. 3 units. *Herzog*

323A. **Comparative Semitic I.** An introduction to the morphology and syntax of classical Ethiopic and the Semitic languages of Mesopotamia, together with a consideration of their relationship to Hebrew. 3 units. *Wintermute*

- 323B. Comparative Semitic II.** An introduction to the morphology and syntax of classical Arabic and the Semitic languages of Palestine-Syria, together with a consideration of their relationship to Hebrew. 3 units. *Wintermute*
- 325. Philosophical Theology I.** Theology, as the knowledge of God, considered in dialogue with selected pagan and Christian philosophers from Plato to Kant. 3 units. *Langford*
- 326. Philosophical Theology II.** Continuation of Philosophical Theology I. 3 units. *Langford*
- 329. Readings in Theology and Language.** Sample treatments of religious language in linguistic analysis, hermeneutical theory, literary criticism, liturgical practice, and fundamental theology. 3 units. *Wainwright*
- 330. Contemporary Christologies.** A seminar dealing with contemporary Roman Catholic and Protestant Christology. Readings and discussion will focus on theological proposals from major contemporary figures. 3 units. *Wainwright*
- 332. System in Theology.** An examination of the various factors that go into the shaping of a systematic theology, followed by a study of several recent and contemporary examples of the genre. 3 units. *Wainwright*
- 333. The Doctrine of the Trinity.** Biblical bases, patristic developments, contemporary statements and connections. 3 units. *Wainwright*
- 335. The English Church in the Eighteenth Century.** Studies of Christianity in England from the Act of Toleration, 1689, to the death of John Wesley, 1791. 3 units. *T. Campbell*
- 336. Worlds and Texts.** The focus of this course will be on specific works in theological method which deal, whether directly or indirectly, with the question of the affiliations between texts and their mediating social and historical realities. 3 units. *Surin*
- 337. Theology of St. Thomas Aquinas.** Intensive reading of the *Summa Theologica* and biblical commentaries. C-L: Medieval and Renaissance Studies. 3 units. *Steinmetz*
- 338. Calvin and the Reformed Tradition.** The theological development of John Calvin. A comprehensive examination of his mature position with constant reference to the theology of other reformers. C-L: Medieval and Renaissance Studies. 3 units. *Steinmetz*
- 339. The Radical Reformation.** Protestant movements of dissent in the sixteenth century. Special attention will be devoted to Müntzer, Carlstadt, Hubmaier, Schwenckfeld, Denck, Marpeck, Socinus, and Menno Simons. C-L: Medieval and Renaissance Studies. 3 units. *Steinmetz*
- 340, 341. Seminar in the New Testament.** Research and discussion on a selected problem in the biblical field. Spring only. 3 units each. *Staff*
- 342. American Religious Biography.** A study of the leading biographies of American religious figures and of the qualities of a successful biography. 3 units. *Marsden*
- 343. Readings in Ancient Near Eastern Wisdom Literature.** A survey of the principal Egyptian and Mesopotamian works that relate to biblical wisdom. 3 units. *Crenshaw*
- 346. Practical Reason and Personal Identity: Explorations in Narrative.** This course will deal with questions of the nature of rationality in morality and theology and attend particularly to those suggestions about narrative as the form of such rationality. The readings will involve works by Frei, Ricoeur, Goldberg, MacIntyre, and McClendon, as well as work in literary criticism. 3 units. *Hauerwas*
- 347. Hebrew Narrative Art.** Analysis of the literary craft of selected biblical narratives, and critique of various approaches to studying the art of Hebrew narrative. Prerequisites: knowledge of Hebrew and consent of instructor. 3 units. *Crenshaw*

**350, 351. Old Testament Seminar.** Research and discussion on selected problems in the Old Testament and related fields. Fall only. 3 units each. *Staff*

**352. Seminar in Christian Theology.** Research and discussion of a selected problem in the systematic field. 3 units. *Staff*

**353. Seminar on Text Criticism.** Emphasis upon transmission, versions, apparatus, and method. Prerequisite: reading knowledge of Hebrew and Greek. 3 units. *Bailey*

**360. Special Problems in Religion and Culture.** Intensive investigation of the relations of religion and modernity, using seminal contemporary texts. Topics announced each semester. Prerequisite: consent of instructor. 3 units. *Surin*

**362. Readings in Old Testament and Semitic Studies.** Selected studies in the Hebrew Bible and the languages and literatures of the ancient Near East. 3 units. *Staff*

**363. Readings in New Testament and Christian Origins.** Selected studies on a theme in modern New Testament scholarship. 3 units. *Staff*

**364. Readings in History of Christianity.** Selected issues in the social, material, and intellectual history of Christianity. 3 units. *Staff*

**365. Readings in Christian Theology and Ethics.** An examination of selected topics of historical and contemporary interest in these fields. 3 units. *Staff*

**366. Readings in History of Religions.** Selected studies in cross-cultural and intercreedal material, together with assessment of the problems they pose for the study of religion. 3 units. *Staff*

**367. Readings in Religion and Culture.** Analysis and discussion of theories and of individual research projects. 3 units. *Staff*

**373-374. Elementary Akkadian.** Study of the elements of Akkadian grammar. Reading of neo-Assyrian texts shedding light on the Old Testament. Prerequisite: biblical Hebrew. 6 units. *Bailey*

**383. Moral Theology in the Twentieth Century.** Critical and comparative examination of ethical theory as exhibited in the work of selected contemporary theologians. 3 units. *H. Smith*

**387. Ethical Method.** Selected methodological issues in contemporary theological ethics. 3 units. *H. Smith*

**388. Ethics and Medicine.** A critical study of selected aspects of modern biomedical technology, with special reference to the ethical assumptions informing their development and practice. 3 units. *H. Smith*

**389. Christian Ethics and Contemporary Culture.** A study of the interaction between Christian thought and current social theory. 3 units. *Staff*

#### COURSES CURRENTLY UNSCHEDULED

204. Origen

206. Christian Mysticism in the Middle Ages

209. Old Testament Theology

231S. Seminar in Religion and Contemporary Thought

241. Problems in Reformation Theology

245. Ethics in World Religions

247. Readings in Latin Theological Literature

249. The Lord's Prayer



- 251. Counter-Reformation and Development of Catholic Dogma
- 252. Nineteenth- and Twentieth-Century Roman Catholic Theology
- 256. John Wesley in Controversial and Ecumenical Theology
- 259. Icon Theology
- 262. Marxist Ideology and Christian Faith
- 263. Third World Theology
- 281. Phenomenology and Religion
- 284. The Religion and History of Islam
- 288. Buddhist Thought and Practice
- 289. Theology and Contemporary Secular Understanding of Human Nature
- 290. Current Problems in Christian Social Ethics
- 291. Historical Forms of Protestant Ethics
- 294. Christianity and the State
- 301. Seminar in Contemporary Christian Ethics
- 304A. Targumic Aramaic
- 308. Greek Patristic Texts
- 311. Pharisaic Judaism in the First Century
- 312. Pauline Theology
- 313. The Apostolic Fathers
- 314. Judaism and Christianity in the New Testament
- 317. Seminar in the Greek Apologists
- 318. Seminar in the Greek Fathers
- 319. The Gospel According to Saint Matthew in Recent Research
- 320. Theology, Power, and Justice
- 324. Readings in the History of Religion
- 327. Philosophical Method in Religious Studies
- 328. Twentieth-Century European Theology
- 331. Eschatology
- 334. Theology and Reform in the Later Middle Ages
- 344. Zwingli and the Origins of Reformed Theology
- 380. Existentialist Thought
- 386. Christianity in Dialogue with Other Faiths
- 397. Issues in American Theology
- 398. Colloquium on the Teaching of Religion
- 401. Colloquium on Biblical Studies

## Romance Studies

Professor Pérez Firmat, *Chairman* (205 Languages); Associate Professor Kaplan, *Director of Graduate Studies* (308 Languages); Professors Fein, Garci-Gómez, Jameson, Mudimbe, Osuna, Schor, Stewart, Tetel, Thomas, and Wardropper; Associate Professors Caserta, Hull, Mudimbe-Boyi and Orr, Assistant Professors Bell, Ferrell, Finucci, Ross, Sieburth, and Solterer; Visiting Professor Dorfman

The Department of Romance Studies offers graduate work leading to the A.M. and Ph.D. degrees in French and Spanish. Requirements for the A.M. may be completed by submission of a thesis or by passing a comprehensive examination in the major field. Related work for the A.M. and Ph.D. degrees is required in a second Romance language or in any one or two of a number of other subject areas. A reading knowledge of one foreign language which is outside the major language is required.

In order to undertake graduate study in Romance languages, the entering student should have credit for at least 18 semester hours (or equivalent) above the intermediate level in the major language.

### FRENCH

#### For Seniors and Graduates

**200S. Seminar in French Literature.** Topics to be announced. 3 units. *Staff*

**210. The Structure of French.** Modern French phonology, morphology, and syntax. Readings in current linguistic theory. 3 units. *Hull*

**211. History of the French Language.** The evolution of French from Latin to its present form; internal developments and external influences. C-L: Medieval and Renaissance Studies. 3 units. *Hull*

**223. Semiotics for Literature.** Theoretical writings in general semiotics by Frege, Peirce, Saussure, Mukarovsky, Morris and their applications for textual analysis of French literary works by representative contemporary critics such as Eco, Riffaterre, Corti, and Greimas. Taught in English. C-L: Literature 280. 3 units. *Thomas*

**240. Old French Literature.** An introduction to the reading of medieval French literary texts. C-L: Medieval and Renaissance Studies. 3 units. *Solterer*

**248. French Literature of the Seventeenth Century.** The baroque and the classical: form and meaning in the plays of Corneille, Racine, and Molière. Readings in baroque and précieux poetry. C-L: Medieval and Renaissance Studies. 3 units. *Ferrell*

**251, 252. Literature of the Eighteenth Century.** Problems of literary history, critical reading, and interpretation, focused on varying topics. 6 units. *Stewart*

**255. French Preromantic and Romantic Poetry.** Chénier, Vigny, Lamartine, Musset, Hugo, and Nerval. 3 units. *Orr*

**256. Modern Literature and History.** The problems of history, society, and politics in literature, through the writings of Rousseau, Tocqueville, Michelet, Flaubert, Hugo, Merleau-Ponty, Foucault, and others. 3 units. *Orr*

**257. Problems of Identity in the Nineteenth-Century Novel.** Romanticism and romantic realism, studied especially in the works of Chateaubriand, Stendhal, Constant, de Staël, and Sand. 3 units. *Bell, Jameson, Orr, or Schor*

**258. The Narrative of Social Crisis.** Realism and naturalism, with special emphasis on Balzac, Flaubert, and Zola. 3 units. *Bell, Jameson, Orr, or Schor*

**261. French Symbolism.** Poetry and theories of Baudelaire, Mallarmé, and Rimbaud. Decadence: Lautréamont and Laforgue. 3 units. *Thomas*

**263. Contemporary French Theater.** Dramatic theory; the art of the leading directors; the major texts of Claudel, Anouilh, Sartre, Beckett, Ionesco, Genet, Adamov, Arrabal, and Rezvani. 3 units. *Kaplan, Orr, or Thomas*

**264. Contemporary French Poetry.** The language of poetry. A chronological and theoretical approach to the major poets and movements since 1950. Selections from Bonnefoy, Char, Daive, Deguy, Dupin, Jabès, Jaccottet, Faye, Guillevic, Michaux, Meschonnic, Noël, Oulipo, Ponge, Stefan, Tortel, and others. 3 units. *Orr or Thomas*

**265. French Literature of the Early Twentieth Century.** Emphasis on Gide, Mauriac, Proust, and Colette. 3 units. *Kaplan*

**266. French Literature of the Mid-Twentieth Century.** Emphasis on Malraux, Sartre, Camus, and the *nouveau roman*. 3 units. *Jameson*

**267. Contemporary French Novel.** A chronological and theoretical approach to the major writers and movements since 1970. Selections from Duras, LeClézio, Sallenave, Modiano, Sollers, Tournier, Oulipo, Yourcenar, and others. 3 units. *Kaplan, Orr, or Thomas*

**290S. Studies in a Contemporary Figure.** A writer, philosopher, critic, or artist. 3 units. *Staff*

#### For Graduates

**325. French Prose of the Sixteenth Century.** Rabelais, Marguerite de Navarre, Montaigne, and others. C-L: Medieval and Renaissance Studies. 3 units. *Tetel*

**326. Topics in Renaissance Poetry.** C-L: Medieval and Renaissance Studies. 3 units. *Tetel*

**391, 392. French Seminar.** C-L: Medieval and Renaissance Studies. 3 units. *Bell, Ferrell, Jameson, Kaplan, Mudimbe, Mudimbe-Boyi, Orr, Schor, Solterer, Stewart, Tetel, and Thomas*

**Graduate Reading Course.** An intensive course in French to develop rapidly the ability to read French in several fields. Graduate students only. No credit.

## ITALIAN

### For Seniors and Graduates

**283. Italian Novel of the Novecento.** Representative novelists from Svevo to the most recent writers. 3 units. *Caserta*

**284. Dante.** *La Vita Nuova* and a close reading of the *Inferno*. Conducted in English. C-L: Medieval and Renaissance Studies. 3 units. *Caserta*

**285. Dante.** The *Purgatorio* and the *Paradiso* in the light of Dante's cultural world. Special attention will be given to the poetic significance of the *Commedia*. Prerequisite: Italian 284 or equivalent. C-L: Medieval and Renaissance Studies. 3 units. *Caserta*

## SPANISH

### For Seniors and Graduates

**200S. Seminar in Spanish Literature.** Topics to be announced. 3 units. *Staff*

**210. History of the Spanish Language.** Formation and development of Spanish: internal forces and external contributions. C-L: Medieval and Renaissance Studies. 3 units. *Garci-Gómez*

**241. Colonial Prose of Spanish America.** Narrative forms written in Spanish America during the sixteenth, seventeenth, and eighteenth centuries. 3 units. *Ross*



**242. Colonial Poetry and Theater of Spanish America.** The expression of Renaissance and baroque styles in the Hispanic New World, including works of Sor Juana, Ruiz de Alarcón, Ercilla, and others. 3 units. *Ross*

**245. Modern Spanish-American Poetry.** From *modernismo* to the present. 3 units. *Fein*

**246. Modern Spanish-American Fiction.** Twentieth-century novels and short stories by Borges, Carpentier, Cortázar, Gallegos, Garcia Márquez, Quiroga, and others. 3 units. *Pérez Firmat*

**248. Studies in Spanish-American Literature.** Concentration on single authors, genres, movements, or themes. 3 units. *Dorfman and staff*

**251. The Origins of Spanish Prose Fiction.** Selected examples of the romance and the novel: *Amadís de Gaula*, Diego de San Pedro's *La Cárcel de amor*, the *Abencerraje*, the *Lazarillo*, Montemajor's *Diana*. C-L: Medieval and Renaissance Studies. 3 units. *Wardropper*

**253. Cervantes.** The life and works of Cervantes, with special emphasis on his *Quijote*. C-L: Medieval and Renaissance Studies. 3 units. *Wardropper*

**254. Drama of the Golden Age.** The chief Spanish dramatists of the seventeenth century with readings of representative plays of this period. C-L: Medieval and Renaissance Studies. 3 units. *Wardropper*

**258S. Spanish Lyric Poetry before 1700.** A critical study, based on close reading and discussion, of selected poems of the Middle Ages, Renaissance, and baroque. Special emphasis on the *Razón de amor*, *la Poesía de tipo tradicional*, and Santillana; on Garcilaso, San Juan de la Cruz, Fray Luis de León, and Herrera; on Góngora and Quevedo. C-L: Medieval and Renaissance Studies. 3 units. *Wardropper*

**262. The Romantic Movement.** Principal manifestations of romanticism in Hispanic literature; poetry (Bécquer, Espronceda, Rosalía de Castro), drama (Rivas, Zorrilla), and the novel (Issacs, Mármol). 3 units. *Pérez Firmat or Sieburth*

**266. Nineteenth-Century Prose Fiction.** Readings by novelists such as Valera, Galdós, Alas, and Pardo Bazán in the light of current critical theory. 3 units. *Sieburth*

**275. Modern Spanish Poetry.** Juan Ramón Jiménez, Unamuno, Antonio Machado, the Generation of 1927, and the contemporary poets. 3 units. *Osuna or Pérez Firmat*

**276. Modern Spanish Drama.** The theater of Benavente, Valle-Inclán, Lorca, Casona, Buero Vallejo, Sastre, and Arrabal. 3 units. *Osuna*

**277. Modern Spanish Novel.** From the Generation of 1898 to the present. 3 units. *Osuna or Pérez Firmat*

### For Graduates

**391, 392. Hispanic Seminar.** Each semester one of the following topics will be selected for intensive treatment: the Spanish language in America, studies in medieval literature, studies in the literature of the Golden Age, studies in Latin American literature, studies in the Spanish Renaissance and baroque, studies in Spanish poetry, studies in nineteenth-century Spanish literature, and studies in twentieth-century literature. C-L: Medieval and Renaissance Studies. 6 units. *Staff*

### ROMANCE STUDIES

**218. The Teaching of Romance Languages.** Evaluation of objectives and methods; practical problems of language teaching at the elementary, secondary, and college levels; analysis of textbooks, texts, and audiovisual aids; applied linguistics. 3 units. *Hull*

**310. Computers for the Humanities.** Applications of computers in three major humanistic areas: (a) textual research—concordances, stylistic analysis, critical editing; (b) text processing; and computer-assisted or computer-managed instruction in the humanistic disciplines. No prior training in computing is required. Theoretical lectures and programming practicum. 3 units. *Thomas*

## Slavic Languages and Literatures

Assistant Professors Andrews and Pugh; Professor Emeritus Krynski; Associate Professor Emeritus Jezierski; Adjunct Associate Professor Pelech; Visiting Associate Professor Lahusen

The Department of Slavic Languages and Literatures offers graduate courses in Russian language and literature and limited training in the language and literature of Poland.

Students should have sufficient preparation in the Russian language to enable them to read Russian classical literature in the original. Any presently unscheduled course will be taught in any semester upon request.

### For Seniors and Graduates

**201, 202. Russian Novel of the Nineteenth Century.** 201: 1830 to 1870. 202: 1870 to 1900. Prerequisites: Russian 161 and 162 or equivalents. 6 units. *Staff*

**205. Semiotics and Linguistics.** A survey of modern semiotics, particularly the works of C. S. Peirce and Umberto Eco. Semiotic works directly related to modern linguistic thought and linguistic sign theory. Emphasis on the interdisciplinary aspects of semiotic theory. C-L: English 205. 3 units. *Andrews*

**225. Tolstoy.** *War and Peace* and other works. Prerequisite: Russian 175S or equivalent. 3 units. *Staff*

**232. Dostoevsky.** Emphasis on *Brothers Karamazov* and the theory of the novel. Prerequisite: Russian 176 or equivalent. 3 units. *Staff*

**250. Russian Literary Criticism from Lomonosov to Lotman.** Russian literary criticism from its beginning with Mikhail Lomonosov to its most eminent living practitioner, Iurii Lotman. Some major figures treated are Lomonosov, Karamzin, Belinskii, Chernyshevskii, Dobroliubov, Pisarev, Mikhailovskii, Shklovskii, Bakhtin, Jakobson, Lotman. Taught in English. 3 units. *Pelech*

## COURSES CURRENTLY UNSCHEDULED

**207. Soviet Literature and Culture**

**230. Chekhov**

## Sociology

Professor Land, *Chairman* (268 Sociology-Psychology); Associate Professor Gereffi, *Director of Graduate Studies* (264 Sociology-Psychology); Professors Back, George (psychiatry and Aging Center), Kerckhoff, Maddox, Myers, O'Barr (cultural anthropology), Simpson, Smith, and Tiryakian; Associate Professors DiPrete, O'Rand, Spenner, and Wilson; Assistant Professor Janoski; Professor Emeritus Preiss; Adjunct Professors Manton (demographic studies) and Palmore (psychiatry and Aging Center); Adjunct Assistant Professor Romanelli (Fuqua School of Business)

The department offers graduate work leading to the M.A. and Ph.D. degrees in sociology. Students beginning work toward an advanced degree should have completed a minimum of 12 semester hours of acceptable courses in sociology and an additional 12

semester hours in related work (e.g., other social sciences, statistics, computer science, philosophy, mathematics). Accepted applicants who have not had such preparation may be required to take work beyond the usual requirements. Applicants for admission are required to take the verbal and quantitative aptitude tests of the Graduate Record Examination.

The Ph.D. program requires the student to take three core courses (Sociology 206, 207, 208) and a primary and a secondary specialization. Specializations (with the associated proseminars indicated in parentheses) include Life Course and Aging Studies (Sociology 221); Comparative and Historical Sociology (Sociology 222); Crime, Law, and Deviance (Sociology 223); Population Studies (Sociology 224); and Organizations, Markets, and Work (Sociology 225). Including the two courses outside the department required by the Graduate School, a student entering with only an undergraduate degree and adequate course preparation would need to take a minimum of twelve to fourteen courses to satisfy degree requirements. Up to fifteen credits, the equivalent of five courses, may be transferred for graduate work taken elsewhere.

Further details concerning the general departmental program, the specialities and their requirements, departmental facilities, the faculty, ongoing research, and stipends available may be obtained from the Director of Graduate Studies.

### For Seniors and Graduates

**206. Sociological Theory.** Structure, foundations, and historical antecedents of recent formulations of such theoretical approaches as phenomenological sociology, exchange theory, critical theory, structuralism, neo-Marxist sociology, sociobiology, and action theory. 3 units. *Tiryakian or Wilson*

**207. Social Statistics I: Basic Concepts and Methods.** Review of descriptive statistics; probability concepts; statistical inference, t-tests and the analysis of variance. Bivariate correlation and regression, dummy variables, multiple regression, and the analysis of covariance. Stress on applications. Statistical computing using SPSS and other programs. 3 units. *DiPrete, Land, or Spenner*

**208. Survey Research Methods.** Theory and application of survey research techniques in the social sciences. Sampling, measurement, questionnaire construction and distribution, pretesting and post-testing, response effects, validity and reliability, scaling of data, data reduction and analysis. Prerequisite: Sociology 207 or the equivalent. 3 units. *Back, Kerckhoff, or Smith*

**211A-E. Proseminars in Sociological Theory.** Development of sociological thought, systematic sociological theory, interrelations with other social and behavioral sciences. 3 units. *Tiryakian or Wilson*

- A. Background of Sociology
- B. Formal Aspects of Theory
- C. Sociology of Knowledge
- D. Evolutionary Theory and Sociobiology
- E. Special Topics in Sociological Theory

**212. Social Statistics II: Linear Models, Path Analysis, and Structural Equation Systems.** Model specification, review of simple regression, the Gauss-Markov theorem, multiple regression in matrix form, ordinary and generalized least squares, residual and influence analysis. Path analysis, recursive and nonrecursive structural equation models; measurement errors and unobserved variables. Application of statistical computing packages. Prerequisite: Sociology 207 or equivalent. 3 units. *DiPrete, Land, or Spenner*

**213. Social Statistics III: Discrete Multivariate Models.** Assumptions, estimation, testing, and parameter interpretation for the log-linear, logit, logistic, and probit models.



Model comparisons, application of statistical computing packages and programs. Prerequisite: Sociology 212 or equivalent. 3 units. *DiPrete, Land, or Spenner*

**214. Comparative and Historical Methods.** Scope, methods, and controversies of comparative and historical sociology. 3 units. *Janoski, Smith, or Tiryakian*

**215. Basic Demographic Methods and Materials.** Population composition, change, and distribution. Methods of standardizing and decomposing rates, life tables and population models, analysis of data from advanced and developing countries. Applications of computer programs for demographic analysis. Prerequisite: Sociology 207 or equivalent. 3 units. *Myers*

**216. Advanced Methods of Demographic Analysis.** Theory and estimation methods for life tables. Reproductivity, the stable population model. Graduation, interpolation, and other data adjustments for faulty data. Hazards models. Prerequisite: Sociology 215 or equivalent. 3 units. *Land*

**217A-F. Proseminars in Social Statistics and Research Methods.** Selected topics in the collection and analysis of social science data. 3 units. *Back, Gereffi, Land, Manton, Myers, Smith, Spenner, or Tiryakian*

- A. Discrete and Continuous Models of Measurement
- B. Hazards Models, Event History Analysis, and Panel Data
- C. Dynamic Model and Times Series Analysis
- D. Research Design
- E. Evaluation Research Methods
- F. Special Topics in Social Statistics and Research Methods

**221A-D. Proseminars in Aging and Life Course Analysis.** Selected topics in socialization, human development, status attainment and careers, and the sociology of aging. 3 units. *Back, George, Kerckhoff, Land, Maddox, Manton, Myers, O'Rand, Palmore, or Spenner*

- A. Social Structure and the Life Course
- B. Social Patterns of Personal Development
- C. Social Gerontology
- D. Special Topics in Aging and Life Course Analysis

**222A-D. Proseminars in Comparative and Historical Sociology.** Selected topics in the differentiation and transformation of societies. 3 units. *Gereffi, Janoski, Kerckhoff, Maddox, Myers, Simpson, Smith, or Tiryakian*

- A. Theories of Social Change
- B. Comparative Aspects of Societal Transformation
- C. Theories of Change in Third World
- D. Special Topics in Comparative and Historical Sociology

**223A-E. Proseminars in Crime, Law, and Deviance.** Selected topics in crime and the institutions of social control. 3 units. *Land, Simpson, Tiryakian, or Wilson*

- A. Theories of Crime Causation
- B. Human Development and Criminal Careers
- C. Social Control and the Criminal Justice System
- D. Sociology of Law
- E. Special Topics in Crime, Law, and Deviance

**224A-F. Proseminars in Population Studies.** Selected topics. 3 units. *Back, DiPrete, Land, Maddox, Manton, Myers, O'Rand, or Smith*

- A. Population Dynamics
- B. Mortality, Morbidity, and Epidemiology
- C. Urbanization and Migration
- D. Demography of the Labor Force
- E. Demography of Aging
- F. Special Topics in Population Studies

**225A-E. Proseminars in Organizations, Markets, and Work.** Selected topics in complex organizations, the labor process, and changing occupations. 3 units. *Gereffi, Kerckhoff, Land, Maddox, O'Rand, Simpson, Smith, Spenner, or Wilson*

- A. Organizations and Environments
- B. The Social Psychology of Organizations
- C. Markets and Market Behavior
- D. Careers and Labor Markets
- E. Special Topics in Organizations, Markets, and Work

**226A-H. Proseminars in Social Institutions and Processes.** Selected topics in the sociology of institutions and social and institutional behavior. 3 units. *Back, George, Kerckhoff, Maddox, O'Barr, O'Rand, Smith, Spenner, Tiryakian, or Wilson*

- A. Social Psychology
- B. Social Stratification
- C. Political Sociology
- D. Sociology of Religion
- E. Sociology of Science
- F. Sociology of Education
- G. Medical Sociology
- H. Special Topics in Social Institutions and Processes

**234S. Political Economy of Development: Theories of Change in the Third World.** See C-L: Political Science 234S; also C-L: Cultural Anthropology 234S and History 234S. 3 units. *Bergquist, Fox, Gereffi, or C. Smith*

**255. Political Sociology.** Pluralist, elite, and class theories of the relationship between state and society. Topics include: recent debates on the welfare state, social control, political participation, and state-society relations in socialist economies. C-L: Political Science 255. 3 units. *Smith or Tiryakian*

**282S. Canada.** See C-L: History 282S; also C-L: Cultural Anthropology 282S and Political Science 282S. 3 units. *Cahow*

**284S. Feminist Theory and the Social Sciences.** See C-L: History 284S; also C-L: Cultural Anthropology 284S, Political Science 264S, Psychology 284S, and Women's Studies. *Chafe, Neuschel, O'Rand, C. Smith, or Spenner*

**298S, 299S. Seminar in Selected Topics.** Substantive, theoretical, or methodological topics. 3 units each. *Staff*

### For Graduates

**392. Individual Research in Sociology.** Students will conduct on an individual basis research designed to evaluate a sociological hypothesis of their choice. The process must be completed by preparation of a report on this research in adequate professional style. Prerequisite: Sociology 207, 208 or consent of instructor. 3 units. *Staff*

## The University Program in Toxicology

Professor Graham, *Director* (M255 Davison Building); Professor Abou-Donia, *Deputy Director* (020 Research Park IV); James B. Duke Professor Fridovich, *Deputy Director* (231 Nanaline Duke Building); Professor Richardson, *Deputy Director* (004A Biological Sciences Building); Professor Adams, *Director of Graduate Studies* (M310-B Davison Building)

The University Program in Toxicology seeks to produce investigators with sound training in the scientific basis for research in toxicology who will advance the science of this discipline. After broad general courses in epidemiology and statistics, pathology, and mammalian toxicology, students will be trained in one of three tracks: (1) as generalist

toxicologists, with broad training in the principles and concepts of toxicology and the design of protocols for toxicological assessments; (2) as specialist toxicologists in those areas of toxicology research in which faculty members are currently productive—in pulmonary toxicology, neurotoxicology, immunotoxicology, genetic toxicology (carcinogenesis), and biochemical toxicology; or (3) as ecotoxicologists with broad training in principles and concepts of both toxicology and ecology as they relate to the release, transport, exposure, accumulation, and effects of toxicants in the ecosystem.

The toxicology program faculty is comprised of members from the Departments of Anesthesiology, Biochemistry, Cellular and Molecular Biology, Chemistry, Medicine, Microbiology and Immunology, Neurobiology, Pathology, Pharmacology, Zoology, the School of Forestry and Environmental Studies, and the Duke University Marine Laboratory.

Students seeking a Ph.D. in one of the participating Graduate School departments must make initial application to that department. Students who apply initially for graduate study in one of the departments may also be nominated by that department for admission to the program. Such students should list toxicology as their "Special Field" on the application form. It is expected that most students will have a strong undergraduate preparation in mathematics and the physical and biological sciences with demonstrated excellence of performance as judged by grades in course work and letters of recommendation from former instructors.

Each student in the program will take a series of courses in toxicology as well as courses specified by his or her department. A student will be expected to choose a dissertation advisor in his or her department at least by the end of the first two semesters in the program, and will normally be expected to begin dissertation research during the third semester in residence. Upon satisfactorily completing all degree requirements in the program and in the department, students will be jointly recommended for the Ph.D. degree.

Further information may be obtained from the Director of the Toxicology Program.

## Women's Studies

Jean F. O'Barr, *Director* (207 East Duke Building); Carol Meyers, *Associate Director*

The Women's Studies Program provides a focal point within the university for the study of gender. Students enrolled in any of the university's departments and professional schools may participate in the program through enrollment in the courses listed below, through specialized study in independent research with any of the fifty-four faculty members associated with the program, and through pursuing an M.A. or Ph.D. thesis topic in feminist theory. Students considering a concentration in women's studies are encouraged to consult the Director for assistance in tailoring a program of study suited to their individual professional needs.

*SIGNS: Journal of Women in Culture and Society* is edited at Duke. Internships and work-study positions form an important part of the graduate education of students interested in feminist scholarship.

**Interdisciplinary Course 211S. History of Feminist Thought.** The intellectual history of feminist thought and an analysis of the sex/gender system from medieval through modern times. Examination of classical philosophical, sociological, and literary texts. 3 units. *Neuschel, J. O'Barr, or Pope*

**Interdisciplinary Course 283S. Feminist Theory and the Humanities.** Beliefs about gender in the assumptions, methods, and central issues, as well as the principal subject matter, of mainstream scholarship in traditional humanities disciplines. Consideration will be given to the way particular social and institutional circumstances linked to gender distinctions have, historically, lent the disciplines their particular character and traditional concerns. 3 units. C-L: English 283S and Religion 269S. *Clark, Orr, Pope, or Tompkins*



**Interdisciplinary Course 284S. Feminist Theory and the Social Sciences.** Examination of feminist modes of inquiry in the social sciences. The relationship of gender in economic, political, social, and cultural systems and the resulting methodological shifts in social science disciplines. C-L: Cultural Anthropology 284S, History 284S, Political Science 264S, Psychology 284S, and Sociology 284S. 3 units. *Chafe, Neuschel, O'Rand, C. Smith, or Spinner*

## COURSES ON WOMEN OFFERED BY DEPARTMENTS

Christian Theology 214. Feminist Theology. *McClintock-Fulkerson*  
Cultural Anthropology 215S. The Anthropology of Women: Theoretical Issues. *Staff*  
Cultural Anthropology 251S. American Marriage: A Cultural Approach. *Quinn*  
Cultural Anthropology 272S. Marxism and Feminism. *Smith*  
English 269. American Women Writers. *Pope or Tompkins*  
English 283. Feminist Theory and the Humanities. *Clark, Orr, Pope, Sedgwick, or Tompkins*  
English 287. Feminist Literary Theory. *Pope*  
English 321. Gender and Power in Renaissance Texts. *DeNeef*  
French 290S. Studies in a Contemporary Figure: Wittig. *Orr*  
French 391. French Seminar: Autobiography. *Kaplan*  
History 227-228. Recent United States History: Major Political and Social Movements. *Chafe*  
History 351.40. Colloquium in Women's History. *Scott*  
Literature 282. Structuralism, Poststructuralism and After. *Tompkins*  
Literature 289. Topics in Feminist Theory. *Staff*  
Literature 302. New Criticism in Literary Theory. *Staff*  
Political Science 200A. Contemporary American Feminism. *J. O'Barr*  
Public Policy Studies 264. Women and Justice. *Stack*  
Public Policy Studies 278. Human Service Bureaucracies. *Stack*  
Religion 234. Early Christian Asceticism. *Clark*

## Zoology

Professor Gillham, *Chairman* (227 Biological Sciences); Associate Professor Rausher, *Director of Graduate Studies* (226 Biological Sciences); Professors Costlow, Fluke, Klopfer, Livingstone, McClay, Nicklas, H. Nijhout, Staddon, Tucker, Vogel, Wainwright, Ward, and H. Wilbur; Associate Professors Forward, Laurie, Lundberg, Ruderman, Sutherland, and Uyenoyama; Assistant Professors Nowicki and Roth; Professors Emeriti Bailey, Bookhout, Gregg, Schmidt-Nielsen, and K. Wilbur; Adjunct Professor Schmidt-Koenig; Lecturer M. Nijhout

The Department of Zoology manages a variety of programs tailored to individual needs of students seeking the Ph.D. degree. The A.M. degree may be taken by students en route to the Ph.D., or by those who leave the doctoral program. Ordinarily, only students seeking the doctorate are admitted to the department.

In general, students entering the department will be equipped to pursue advanced degrees if they have completed an undergraduate major in biology along with some formal training in college level chemistry, mathematics, physics, and foreign languages. A reading knowledge of one foreign language is required of all doctoral students in zoology.

Nevertheless, in recognition and support of the modern trend toward interdisciplinary research, the department is prepared to accept promising students with less orthodox academic backgrounds and is ready to encourage any student wishing to undertake a program of study leading, in effect, to an interdisciplinary degree sponsored by the department.

Thus, all students are urged to search widely in both the *Bulletin of Duke University: Undergraduate Instruction* and the *Bulletin of Duke University: Graduate School* for information about the intellectual resources of the University. Special attention should be given to announcements of the Departments of Biochemistry, Biological Anthropology and Anatomy, Botany, Cell Biology, Chemistry, Cultural Anthropology, Geology, History, Mathematics, Microbiology and Immunology, Pharmacology, Philosophy, Psychology,

Sociology, and Zoology; announcements of the Schools of Engineering and Forestry and Environmental Studies should also be consulted.

### For Seniors and Graduates

The *L* suffix on a zoology course number indicates that the course includes a laboratory.

**200. Advanced Neuroscience I.** Prerequisite: Psychology 103. See C-L: Psychology 200. 3 units. *Cant and McClay*

**201L. Animal Behavior.** Survey of past developments and current controversies in animal behavior. Extensive readings, followed by individual experimental or descriptive projects in the laboratory or field (or Primate Center). Recommended background: Biology 74L, Biology 151L, and Statistics 117, or equivalents. 4 units. *Klopfer*

**203L. Marine Ecology.** Application of ecological theory to marine systems. Emphasis on hypothesis formulation, field experimentation, data analysis, scientific writing, and familiarity with current ecological literature. Prerequisite: course in introductory ecology, invertebrate zoology, or marine botany (phycology); knowledge of statistics helpful. Offered at Beaufort. C-L: Marine Sciences 203L. 6 units. *Hay (visiting summer faculty)*

**206S. Controversies in Biology.** A contentious theme for reading, discussion, and an individual or joint paper. Illustrative past topics: the nature of the creative process, causality in biological thought, the lack of political impact of many scientific developments. Open to nonmajors. 3 units. *Klopfer*

**213L. Behavioral Ecology.** How ecological factors shape foraging, mating, aggressive and social behavior. Laboratory experiments and field observations from the Outer Banks environment. Independent projects and seminars. Prerequisite: introductory biology. C-L: Marine Sciences 213L. 4 units. *Rubenstein (visiting summer faculty)*

**216L. Limnology.** Lakes, ponds, and streams: their origin, development, geochemistry, energy balance, productivity, and the dynamics of plant and animal communities. Laboratory includes field trips. Offered biennially. Prerequisites: introductory biology and Chemistry 12 and physics and Mathematics 32 or consent of instructor. 4 units. *Livingstone*

**222L. Entomology.** The biology of insects: diversity, development, physiology, and ecology. Field trips. Prerequisite: introductory biology. 4 units. *H. Nijhout*

**226L. Ichthyology.** Diversity, evolution, natural history, and ecology of fishes. Laboratory includes overnight field trips to marine and freshwater habitats. Prerequisites: introductory biology and Biology 108L or equivalent. 3 units. *Lundberg*

**234S. Problems in the Philosophy of Biology.** Prerequisite: consent of instructor. See C-L: Philosophy 234S; also C-L: Botany 234S. 3 units. *Brandon (philosophy)*

**237L. Systematic Biology.** Theory and practice of identification, species discovery, phylogeny reconstruction, classification, and nomenclature. Prerequisites: introductory biology and one course in animal or plant diversity. C-L: Botany 237L. 3 units. *Lundberg and Mishler (botany)*

**244. Principles of Immunology.** Prerequisites: Biology 160 and Chemistry 152 or consent of instructor. See C-L: Microbiology and Immunology 244. 3 units. *Amos, McClay, and staff*

**245S. Radiation Biology.** The biological effects of ionizing radiations: classical concepts in the context of recent research papers. Analytical uses of radiation. Prerequisites: introductory biology, Chemistry 11, 12, and Physics 51, 52. 3 units. *Fluke*

**247S. Photobiology.** Effects of visible light and of ultraviolet and near ultraviolet radiation in living systems: repair processes, quantum processes, physical optics. Prerequisites: college physics and introductory biology. 3 units. *Fluke*

**249. Comparative Biomechanics.** The structure and operation of organisms in relation to the mechanics of solids and fluids, including readings from the primary literature. Prerequisites: Physics 51 and Mathematics 31 or equivalents. Not open to students who have taken Biology 149. 3 units. *Vogel and Wainwright*

**250L. Physiology of Marine Animals.** Environmental factors, biological rhythms, and behavioral adaptations in the comparative physiology of marine animals. Prerequisites: introductory biology and chemistry. C-L: Marine Sciences 250L. 4 units. *Forward*

**259L. Laboratory in Biomechanics.** Introduction to instruments used in investigations of solid and fluid biomechanics. Exercises and individual projects. Prerequisite: Zoology 249. 3 units. *Vogel and Wainwright*

**262. Biology of Parasitism.** How parasites, from viruses through vertebrates, have solved the special problems associated with their dependence on other organisms. Emphasis on life cycles, host-parasite interactions, and experimental parasitology. Prerequisites: cell biology and animal diversity. 3 units. *M. Nijhout*

**267L. Community Ecology.** Mechanisms that determine the distribution and abundance of plants and animals: geology, climate, physiography, soils, competition, predation, and history. Lectures focus on ecological principles. Seminars and weekend field trips. Prerequisites: an introductory ecology course and consent of instructor. C-L: Botany 267L. 3 units. *Christensen (botany) and Wilbur*

**269. Advanced Cell Biology.** Structural and functional organization of cells and their components with emphasis on current research problems and prospects. Prerequisite: introductory cell biology or consent of instructor. C-L: Botany 269, Cell Biology 269, Microbiology and Immunology 269, and The University Program in Cell and Molecular Biology. 3 units. *McClay and staff*

**274L. Marine Invertebrate Zoology.** Structures, functions, and habits of invertebrate animals under natural and experimental conditions. Field trips included. Not open to students who have taken Biology 76L or 176L. Prerequisite: introductory biology. Offered at Beaufort. C-L: Marine Sciences 274L. 6 units. *Ruppert (visiting summer faculty)*

**278L. Invertebrate Developmental Biology.** Gametogenesis, fertilization, and development of invertebrates, with emphasis on experimental studies of prelarval stages. Prerequisite: consent of instructor. Offered at Beaufort. C-L: Marine Sciences 278L. 6 units. *McClay and visiting staff*

**280. Principles of Genetics.** Structure and properties of genes and chromosomes in individual organisms and in populations. Prerequisite: introductory biology. C-L: Botany 280 and The University Program in Genetics 280. 3 units. *Antonovics (botany), Boynton (botany), Gillham, and Laurie*

**281. DNA, Chromosomes, and Evolution.** The relationship of chromosome and DNA-sequence organization with evolution; karyotype changes and speciation; repetitive DNA, split genes, transposable elements, and evolutionary mechanisms; phylogeny reconstruction; evolution of mitosis and the chromosome cycle. Prerequisites: an introductory course in genetics or cell or molecular biology, or consent of instructor. C-L: The University Program in Genetics. 3 units. *Laurie and Nicklas*

**283. Extrachromosomal Inheritance.** Genetics, biochemistry, and molecular biology of the organelles of eukaryotic cells, and cellular symbionts. Emphasis on recent literature. Prerequisite: introductory genetics. C-L: Botany 283 and The University Program in Genetics. 3 units. *Boynton (botany) and Gillham*



**286. Evolutionary Mechanisms.** Prerequisites: Biology 140L and a course in genetics. See C-L: Botany 286; also C-L: The University Program in Genetics. 3 units. *Antonovics (botany), Uyenoyma, and H. Wilbur*

**287S. Macroevolution.** Evolutionary patterns and processes at and above the species level; species concepts, speciation, diversification, extinction, ontogeny and phylogeny, rates of evolution, and alternative explanations for adaptation and evolutionary trends. Prerequisite: one course in plant or animal diversity. C-L: Botany 287S. 3 units. *Mishler (botany) and Roth*

**288. Mathematical Population Genetics.** Principles of formulation and analysis of dynamic mathematical models of genetic evolution. Rotating topics include: mating systems, sex ratio, stochastic processes. Prerequisite: calculus; statistics and linear algebra recommended. C-L: The University Program in Genetics. 3 units. *Uyenoyma*

**290. Modeling Biological Systems.** The tools commonly used for analyzing, interpreting, and criticizing mathematical models of biological systems. Difference equations, differential equations, stability theory, phase plane methods, bifurcations. Prerequisite: calculus and consent of instructor. 3 units. *Edelstein-Keshet*

**293L. Population Biology.** See C-L: Botany 293L. 3 units. *Antonovics (botany) and H. Wilbur*

**295S, 296S. Seminar.** Topics, instructors, and course credits announced each semester. C-L: Marine Sciences 295S, 296S. 3 units. *Staff*

#### For Graduates

**353, 354. Research.** To be carried on under the direction of the appropriate staff members. Hours and credit to be arranged. C-L: Marine Sciences 353, 354. *Staff*

**360, 361. Tutorials.** An approved academic exercise, such as writing an essay or learning a research skill, carried out under the direction of the appropriate staff members. Hours and credit to be arranged. *Staff*

#### COURSES CURRENTLY UNSCHEDULED

**233. Principles of Insect Behavior**

**355, 356. Seminar**

#### RELATED PROGRAMS

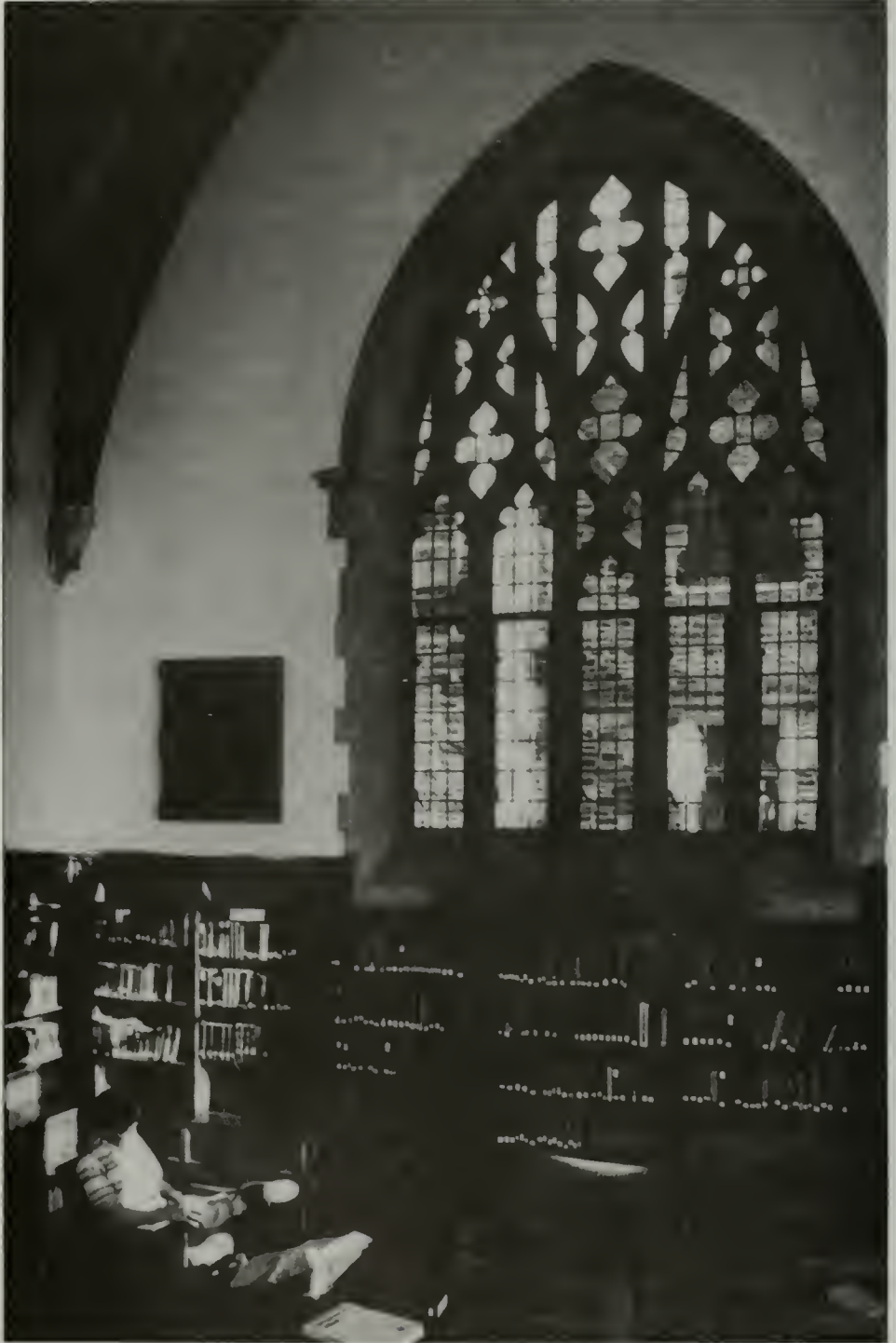
**The University Program in Cell and Molecular Biology.** See announcement in this bulletin.

**The University Program in Genetics.** Genetics courses offered by the Department of Zoology are part of the University Program in Genetics; see announcement in this bulletin.

**The University Program in Marine Sciences.** Consult Marine Sciences in this bulletin for offerings at the Duke University Marine Laboratory.

**Program in Tropical Biology.** Fellowships are available for travel and subsistence in field-oriented programs in Latin America. Refer to the section Organization for Tropical Studies in this bulletin in the chapter on "Special and Cooperative Programs."

*Special and Cooperative Programs*



## **Center for the Study of Aging and Human Development**

The center is a multidisciplinary program devoted to research, training, and clinical activities in gerontology and geriatrics. Although the center does not offer degrees, the varied programs, research laboratories, and clinical settings provide a context and resource for undergraduate and graduate students and for health professionals with special interests in adult development and aging. The center conducts multidisciplinary, two-year programs for postdoctoral fellows interested in focused training for independent research on many varied aspects of aging and adult development. Resources of this all-University program include data from two longitudinal studies, a wide range of archival data of special interest to social scientists, an animal colony, and the center's basic and applied research laboratories. A division of geriatrics coordinates research, training, and services related to the care of older adults. Undergraduate and graduate students of the University are welcome to inquire about participation in all programs at the center. Inquiries should be addressed to Harvey Jay Cohen, M.D., Director, Duke University Center for the Study of Aging and Human Development, Box 3003, Duke University Medical Center, Durham, North Carolina 27710.

## **Asian-Pacific Studies Institute**

The institute sponsors an agenda of visiting speakers and scholars and coordinates study abroad programs in China and Japan. A limited number of fellowships are granted which provide stipends for a two-year period. Incoming graduate students with the Ph.D. as their objective, students in good standing in the first year of study in Duke professional schools, and current Duke students enrolled in Ph.D. programs may be considered for these fellowships. Further information may be obtained from the Asian-Pacific Studies Institute, 2111 Campus Drive, Duke University, Durham, North Carolina 27706.

## **The Center for Biochemical Engineering**

The Center for Biochemical Engineering offers versatile and broad education at the graduate level for students interested in developing and using engineering principles to understand and implement biological and biochemical processes. The programs of study in biochemical engineering are thus interdisciplinary. Students follow a program of course work to reinforce advanced principles of chemical process engineering, mathematics, and physics, as well as microbiology, biochemistry, immunology, and genetics. Close relations



are maintained with many departments and schools of the University, and research projects involving work in these other departments are encouraged. Major emphasis is placed on study leading to the Ph.D., the traditional degree of scholarship awarded for mastery of a significant field of knowledge. This mastery is demonstrated by a combination of course work in a major and minor field, completion of an original research project submitted as a dissertation, and a successful defense of the research. Programs leading to the Master of Science degree are also available. Students from non-engineering programs are encouraged to apply to either degree program. Further information may be obtained from the Director of Graduate Studies, The Center for Biochemical Engineering, Duke University, Durham, NC 27706.

## **Canadian Studies Program**

The Canadian Studies Program is supported in part by grants from the U.S. Department of Education, the Ford Foundation, the Mellon Foundation, and by occasional funds from the departments of Canada's provincial and federal governments. Its purpose is to formalize and expand the interest of graduate students in Canada, to introduce the study of Canadian life and culture at the undergraduate level, and to encourage such study in primary and secondary schools.

The program awards a limited number of graduate fellowships and teaching assistantships for the study of Canada to American residents. Fellows must work on a Canadian dissertation topic within their disciplines. Grants of travel aid for field research in Canada are also offered.

The program sponsors lectures by Canadian specialists and supports seminars devoted to Canada. Opportunities for study in Canada are offered to honors undergraduates in Canadian Studies, graduates, and faculty.

Inquiries should be addressed to the Director, Canadian Studies Center, 2016 Campus Drive, Duke University, Durham, North Carolina 27706.

## **Program in Russian and East European Studies**

The graduate school of Duke University offers a program leading to the A.M. and Ph.D. degrees in several disciplines (economics, history, literature, linguistics, and political science), with a concentration in Russian and East European studies. Students are encouraged to utilize the libraries and facilities of both Duke and the University of North Carolina at Chapel Hill. The holdings of the two libraries in Russian and East European materials are substantial and complementary. Both libraries have a policy of purchasing all significant published works in Slavic history, economics, government, geography, literature, and linguistics. Other joint activities include periodic colloquia involving the personnel of the two institutions and distinguished visiting scholars.

For more information, contact Professor Martin A. Miller, Chair, Russian and East European Studies Committee, Center for International Studies, 2101 Campus Drive, Duke University, Durham, North Carolina 27706.

## **Center for Demographic Studies**

The center promotes research and training in demographic studies. Its facilities, located at 2117 Campus Drive, include a population library, the Joseph J. Spengler Collection of publications and research materials, and extensive data resources. The center does not offer degrees; it promotes the pursuit of advanced degrees, with a specialization in population studies, through either the Department of Sociology or the Department of Economics. The center's program provides opportunities for direct student participation in ongoing research projects. The program of extramural research stresses, but is not limited to, applied work in the demography of aging, health, mortality, fertility, and migration.

Inquiries for training opportunities may be directed to Dr. George C. Myers, Director, Center for Demographic Studies, 2117 Campus Drive, Durham, North Carolina 27706.

## **The Program for the Study of Developed Shorelines**

The Program for the Study of Developed Shorelines was established in recognition of a critical need for both academic programs and geological research on national coastal issues. The goal of the program is promotion of research, education, and publications concerned with oceanic shorelines already under development. A limited number of graduate research fellowships are available to both M.S. and Ph.D. candidates and post-doctoral support is available for individuals involved in appropriate research. The program is centered entirely within the Department of Geology and fellows supported by the program must satisfy all departmental requirements. For more information contact Professor Orrin Pilkey, Director, Program for the Study of Developed Shorelines, Department of Geology, Duke University, Durham, North Carolina 27709.

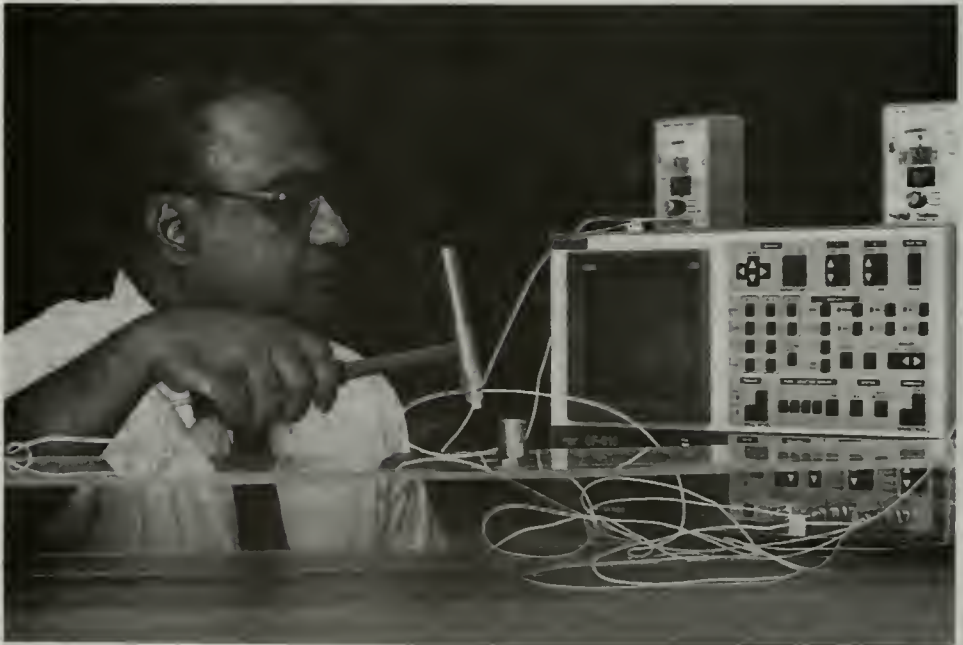
## **Islamic and Arabian Development Studies**

The program in Islamic and Arabian Development Studies, established in 1977 with support from some twenty American and foreign corporations, sponsors teaching and research on Islamic themes with special reference to developmental problems of the Arabian peninsula. Emphasis is also placed on Afghanistan, Pakistan, and Muslim refugees. The program has sponsored four international conferences, has sent groups of faculty and students to Jordan and Saudi Arabia, and has sponsored Duke student delegations to the Model Assembly of the League of Arab States. Its fourth international conference was held at the Rockefeller Conference Center, Bellagio, Italy, in October 1987 on the topic of Muslim refugees. The program arranged for the acquisition by the Perkins Library of the Malone Collection on Arabian Affairs and the Louis and Nancy Hatch Dupree Collection on Islamic Inner Asia. Its publication series includes volumes on Islam in the Philippines, the Genesis of American Orientalism, and Muslim refugees, as well as volumes on Pakistan and Saudi Arabia. It also sponsors an outreach program which includes Appalachian State University, Belmont Abbey College, the College of Charleston, Converse College, Davidson College, Johnson C. Smith University, Old Dominion University, and the University of the South. Inquiries should be addressed to Dr. Ralph Braibanti, Director, Islamic and Arabian Development Studies, 2114 Campus Drive, Duke University, Durham, North Carolina 27706.

## **Latin American Studies Program**

The Graduate School offers an interdepartmental program in Latin American studies in conjunction with several departments: anthropology, history, economics, political science, sociology and Romance languages. In addition to fulfilling the requirements of their departments, students in the Latin American Studies Program undertake special courses of interdisciplinary study to broaden their knowledge of the Latin American field.

The holdings of Perkins Library for graduate work and research in Latin American history, inter-American relations, economic history, politics, art, and Spanish-American literature are constantly being enlarged. Program faculty are involved in different national research programs dealing with Latin American topics and offer advice on fellowship support for graduate research in Latin America and the Caribbean. Inquiries should be directed to the Council on Latin American Studies, Center for International Studies, 2122 Campus Drive, Duke University, Durham, North Carolina 27706.





## Medical Historian Training Program

The Medical Historian Training Program is conducted under the auspices of the School of Medicine and the Graduate School. The M.D.-Ph.D. program requires a minimum of six years of graduate and medical study, and the M.D.-A.M. four or five years, depending on the use of summer terms. The M.D.-Ph.D. program is intended for those students who know that their major career effort will be in teaching and other scholarly activities in the history of medicine (not necessarily to the total exclusion of clinical medicine). The M.D.-A.M., on the other hand, is appropriate for those who are undecided, but who wish to acquire a firm foundation for future study. In both programs the first two years and the last year will be spent in the medical school. All requirements for the Ph.D. and the A.M. must be completed before the final year of the M.D. program.

**Application and Admission Procedures.** Applicants must meet the requirements for admission to the School of Medicine and the Graduate School in the Department of History including the MCAT and GRE exams. Those candidates holding the M.D. degree will be considered for the Ph.D. and the A.M. degrees. Candidates who have completed two years of medical school will also be considered for either degree.

Applicants should complete and submit an application to the Graduate School for admission to the Department of History.

Additional information may be obtained by writing to Dr. Peter Wood, Director of Graduate Studies, Department of History, 233 Allen Building, Duke University Durham, North Carolina 27706.

## Medical Scientist Training Program

The Medical Scientist Training Program, conducted under the auspices of the Graduate School and the School of Medicine, is designed for students with a strong background in science who are motivated toward a career in the medical sciences and academic medicine. It provides an opportunity to integrate graduate education in one of the sciences basic to medicine with the clinical curriculum of the School of Medicine. The program usually requires six to seven years of study and leads to both the M.D. and Ph.D. degrees. Although the special emphasis of this program is on basic medical science, the trainees, because of their education in clinical medicine, have a remarkable range of career opportunities open to them. Graduates of this program generally follow one of two broad paths. Some directly pursue careers in teaching and research in one of the basic medical sciences, while maintaining strong ties with clinical science as a result of their combined training; others enter residency programs before pursuing investigative and teaching careers in clinical medicine, carrying with them strong academic backgrounds in the basic sciences.

**Eligibility.** Applicants must meet the admission requirements of both the Graduate School as a candidate for the Ph.D. degree and the School of Medicine as a candidate for the M.D. degree. Most candidates apply for admission to the first year of the program, but applications are sometimes accepted from students who are enrolled in appropriate stages of their curriculum in the Graduate School or School of Medicine of Duke University. In addition to the minimum requirements for acceptance in the Graduate School and the School of Medicine, advanced course work in science and mathematics as well as prior research experience count heavily in the selection of candidates.

**Financial Support.** Students admitted to the first year of the program can receive a traineeship award, consisting of a stipend and full tuition allowance, provided by a grant from the National Institutes of Health. The present annual stipend is \$8,500. Current policy of the National Institutes of Health limits the duration of the traineeship to six years, but the years need not be consecutive; this permits curricula which take more than six years.

This traineeship, created by the National Research Service Award Act of 1974 (PL 93-348) provides (as do all research training awards under this act) for certain alternate

service or payback requirements in the event that a research career is not pursued. Support by the NIH under the National Research Service Award Act requires the recipient to be a citizen or resident of the United States.

**The Training Program.** This program has been designed to offer trainees latitude in the selection of course material. Basic requirements are two academic years composed of the first basic science year and the second clinical science year of the curriculum for medical students at Duke University. Following completion of the second year, the trainee enters the graduate program to complete the requirements for the Ph.D. degree. A final academic year of elective clinical study is necessary to complete the requirements for the M.D. degree. Both degrees are awarded at the completion of this sequence.

Additional information may be obtained by writing Professor Salvatore V. Pizzo, Medical Scientist Training Program, Department of Pathology, Box 3711 Duke University Medical Center, Durham, North Carolina 27710.

## **Oak Ridge Associated Universities**

Duke University is one of the sponsoring universities of the Oak Ridge Associated Universities located at Oak Ridge, Tennessee. The graduate research program at Duke has available to it all the facilities of the Oak Ridge National Laboratory and the cooperative supervision of student research by the staff at Oak Ridge. Fellowships in several fields of science are available to qualified applicants.

**Graduate Fellowship Program.** On application by a university, ORAU awards fellowships to candidates for the master's and doctor's degrees. The student uses the fellowship to conduct thesis research in certain federal laboratories.

The application deadlines depend upon the fellowship. Further information may be obtained from Judith Argon, Office of Research Support, 001E Allen Building.

## **Office of Research Support**

The Office of Research Support, located in 001E Allen Building, provides assistance to faculty members (outside the Medical Center) who seek research funding and to graduate students who seek graduate fellowships. The office houses a library of reference materials dealing with external funding. The ORS Fellowship File contains fellowship information for faculty, postdoctoral fellows, and graduate students from a variety of sources. It is arranged primarily by discipline and also includes such categories as "study abroad" and "dissertation support." Graduate students may take advantage of the resources of the office by browsing through the information on their own or they may make an appointment to talk with the staff by calling 684-3030. The office also reviews all grant proposals submitted to external funding sources, negotiates with the agency, and processes the award. Office hours are from 8:30-5:00 daily; no appointment is necessary.

## **Center for Resource and Environmental Policy Research**

The Center for Resource and Environmental Policy Research at Duke University is committed to the study of public policies on natural resources and the environment. Housed in the School of Forestry and Environmental Studies and initially supported by the Andrew W. Mellon Foundation, the center combines the efforts of a small permanent faculty with participation by business leaders, government officials, and the faculty and students of Duke University and other universities to provide a center of excellence for the analysis of contemporary resource and environmental policy issues. The center offers a forum for the examination of public and private responsibilities for natural resources and the environment and provides a means to link the specialized knowledge of academia with the information needs of government and industry.

Graduate research assistantships are offered to qualified students researching resource and environmental policy problems. Support is available to students pursuing M.S., A.M., or Ph.D. degrees through the Graduate School at Duke University and in conjunction with the School of Forestry and Environmental Studies or other departments. Course work is offered in both intensive and semester-long formats.

For further information, write to the Center for Resource and Environmental Policy Research, 212 Biological Sciences Building, Duke University, Durham, North Carolina 27706.

## Organization for Tropical Studies

Duke University is a member of an international consortium created to provide leadership in education, research, and the wise use of natural resources in the tropics. The basic OTS course, *Tropical Biology: An Ecological Approach*, extends for an eight-week period in January-March and in July-August. Advanced offerings are scheduled periodically in agroecology, anthropology, botany, earth sciences, forestry, geography, marine biology, meteorology, and zoology.

The application deadlines are March 1 and October 1. Fellowship applications for travel and subsistence in the field-oriented programs conducted in Costa Rica are available through the faculty representatives. Consult Dr. Donald Stone (botany), Dr. Richard White (botany), or Dr. John Lundberg (zoology) for information.

## Center for Research on Women

The Duke-UNC Center for Research on Women was founded in 1982 as a collaborative endeavor between Duke University and the University of North Carolina at Chapel Hill to promote women's studies scholarship and research throughout the tri-state area of North Carolina, South Carolina, and Virginia; to support curriculum development in women's studies; and to disseminate women's studies research and information throughout the South. The center's principal focus is to explore the intersection of gender, race, and class, with a particular emphasis on the American South and Third World societies.

The center offers postdoctoral humanist-in-residence fellowships, funded by the Rockefeller Foundation, a limited number of unpaid visiting scholar affiliations, and opportunities for graduate student internships. Regular activities include an annual visiting lectureship series; a working paper series, *Southern Women: The Intersection of Race, Class and Gender*, published jointly with the research centers at Memphis State University and Spelman College; the publication of a biannual newsletter, *Branches*; and sponsorship of conferences, colloquia, and community events. The research center also houses *SIGNS: A Journal of Women in Culture and Society*.

The research center is located at 207 East Duke Building, (919) 684-6641, on the Duke campus, and at 03 Caldwell Hall 009A at UNC, (919) 966-5787. Dr. William H. Chafe is the Academic Director and Dr. Christina Greene is the Project Director.



*Resources for Study*



## The Libraries

The libraries of the University consist of the William R. Perkins Library and its seven branches on campus: Biology-Forestry, Chemistry, Divinity, East Campus, Engineering, Music, and Mathematics-Physics; the Pearse Memorial Library at the Duke Marine Laboratory in Beaufort; and the independently administered libraries of Fuqua (Business), Law, and Medicine. In June 1988, these libraries contained approximately 3,669,724 volumes. Approximately 8,958 periodicals, 9,685 serials, and 222 newspapers are received regularly. The collection includes about 2.6 million manuscripts, 90,000 maps, 42,500 music scores, 535,000 microform pieces, and over 1,000,000 public documents.

In addition to noteworthy holdings in British history, English literature, American history and literature, Commonwealth studies, Latin American history, religion, and science, the libraries include several distinguished special collections of international reputation such as the George Washington Flowers Collection of Southern Americana, the Baker Collection of Wesleyana and British Methodistica, the Mazzoni Collection of Italian Literature, the Perez de Velasco Collection of Latin American History, the Jantz Collection of German Baroque Literature and German Americana, the Trent Collection of Walt Whitman, the Trent Collection in the History of Medicine, and the Strisower Collection of International Law. The J. Walter Thompson Newspaper Archives were acquired during the past year.

### THE WILLIAM R. PERKINS LIBRARY

**Collections.** The William R. Perkins Library, the main library of the University, houses most of the books and journals in the humanities and social sciences, large files of United States federal and state documents, public documents of many European and Latin American countries, publications of European academies and learned societies, and special collections from South Asian, Far Eastern, and Slavic countries. The newspaper collection, with nearly 530,000 microform pieces and several thousand bound volumes, has long eighteenth-century files; strong holdings of nineteenth-century New England papers; antebellum and Civil War papers of North Carolina, South Carolina, Virginia, and Georgia; and many European and Latin American papers. The manuscript collection of approximately 7,500,000 items is particularly strong in all phases of the history, politics, and social and economic life of the South Atlantic region and includes significant papers in English and American literature. The collection in the Rare Book Room contains scarce and valuable materials covering a broad range of fields. The Latin and Greek manuscript collection constitutes one of the outstanding groups of its kind in the United States. The collection of Confederate imprints is the largest in the country.

The branch libraries serve the academic disciplines bearing their names. The East Campus Library is primarily for undergraduate use; however, it also contains the principal collections for graduate and undergraduate study in art.

Materials on reference services, closed and open carrels, interlibrary loans, and microfilming/photocopying are available in the library.

### **THE MEDICAL CENTER LIBRARY**

The Medical Center Library, located in the Seeley G. Mudd Communications Center and Library Building on the Medical Campus, provides services and informational resources necessary to further education, research, and clinical activities in the medical field. In addition to the faculties and students in the Schools of Medicine, Allied Health, and Medical Center graduate departments, the library serves the professional and technical staffs of Duke Hospital as well as other health professionals throughout North Carolina. Over 232,000 volumes are available; approximately 2,650 journal subscriptions are received currently. Professional reference librarians are available for assistance in the use of library resources, and arrangements may be made for individual or group tours, instruction, or specialized seminars.

The History of Medicine Collections, including the Josiah C. Trent Collection, consist of rare books and manuscripts and a supporting group of histories, biographies, bibliographies, pictures, and ephemeral materials. The rare books are available to all, but are restricted to library use. Most modern books may be borrowed. The History of Medicine Collections also include the Duke Authors Collection, which preserves an archival copy of each book published by a member of the Duke medical faculty.

The Frank Engel Memorial Collection consists of a small group of books for leisure reading in nonmedical subjects, supplemented by several newspapers and popular magazines.

A reserve collection of heavily used books and journals is maintained in the Medical Sciences Branch Library located in the Nanaline Duke Building and covers the fields of biochemistry, genetics, pharmacology, and physiology.

### **THE SCHOOL OF LAW LIBRARY**

The School of Law Library, with over 370,000 volumes, serves both the University and the local legal community. It features comprehensive coverage of basic Anglo-American primary source materials, including nearly all reported decisions of federal and state courts, as well as current and retrospective collections of federal and state codes and session laws. Digests, legal encyclopedias, and other indexing devices provide access to the primary documents. A large section of the library collection is devoted to treatises on all phases of law and legal sciences, as well as history, economics, government, and other social and behavioral sciences relevant to legal research. The treatises are organized in the Library of Congress classification system and are accessible through a public catalog. Special treatise collections are maintained in several subject areas, including the George C. Christie collection in jurisprudence and the Floyd S. Riddick collection of autographed senatorial material. The library is a selective depository for United States government publications, with concentration on congressional and administrative law materials. The library receives the records and briefs from the United States Supreme Court, the Fourth Circuit Court of Appeals, and the North Carolina Supreme Court and Court of Appeals. In addition to its Anglo-American holdings, the library holds substantial research collections in foreign and international law. The foreign law collection is extensive in coverage, with concentrations in European law and business law materials. The international law collection is strong in primary source and treatise material on both private and public international law topics. Undergraduate and graduate students whose course of study requires access to legal literature may use the library. However, access to the library may be restricted during certain times because of accreditation standards.



## RECORD LIBRARY

The Department of Music has a record library separate from the university libraries with facilities for listening to records and tapes. While all materials may be used in the listening room, recordings from the departmental collection may be borrowed only by faculty of the Department of Music. Any member of the community may borrow from the Arts Council Collection of more than 2,700 records for a nominal fee.

## UNIVERSITY ARCHIVES

The Duke University Archives, the official archival agency of the University, collects, preserves, and administers the records of the University having continuing administrative or historical value. The institutional archives, which also include published material, photographs, papers of student groups and faculty, and selected memorabilia, are available for research under controlled conditions in 341 Perkins Library.

## Science Laboratories

**Computation Center.** The Duke University Computation Center (DUCC) maintains an IBM 3083 System Complex with sixteen megabytes of memory, eight IBM 3380 disk drives, eight IBM 3350 disk drives, eight IBM 3330-11 disk drives, six IBM 3420 tape drives, one Xerox 8700 laser printer, three IBM high-speed printers, a CalComp digital plotter, and an IBM 2540 card reader/punch. The DUCC facility is connected by a high-speed microwave to the Triangle Universities Computation Center (TUCC) located in the Research Triangle Park.

TUCC is a regional computer network formed and operated jointly by Duke University, North Carolina State University at Raleigh, and the University of North Carolina at Chapel Hill. The computer equipment at TUCC consists of one IBM 3081 with thirty-two million bytes of memory, multiple 3330- and 3350-type disk drives, thirteen tape drives, card readers, and printers.

Duke's IBM 3083 is used mostly for administrative computing and as a high-speed link to TUCC. Also connected to TUCC are four medium-speed printers located in the Engineering Building, the Biological Sciences Building, the Sociology-Psychology Building, and West Duke Building on East Campus, as well as seven low-speed keyboard terminal clusters located at various points around the University. Seven clusters and two laboratories of IBM personal computers are also available. The laboratories are located in the Engineering Building and in North Building. Also available are several APPLE MacIntosh microcomputer clusters.

All users of the Computation Center facilities are urged to obtain funds to pay for computer services. Users unable to obtain grant funding may ask for financial support from their departments when applying for services. More specific information regarding Duke computing facilities may be obtained from the Director of the Computation Center.

**Botanical and Zoological Laboratories.** Facilities for graduate study in the Departments of Botany and Zoology are located on the West Campus. The Biological Sciences Building contains well-equipped modern laboratories for teaching and research in the fields of botany, forestry, and zoology. Special facilities include animal rooms, greenhouses, darkrooms, refrigerated and controlled-environment laboratories, scanning and transmission electron microscopes, a Van de Graaf accelerator, X-ray machines, radiation and radioisotope equipment, and other modern research facilities. Extensive facilities for experimentation in environmental control of plant growth are available in the phytotron adjacent to the botany greenhouses.

The herbarium contains over 500,000 specimens and includes notable collections of mosses and lichens. Other assets for teaching and research are the Sarah P. Duke Gardens on the West Campus; the eleven-acre experimental plot and field laboratory developed by the Department of Botany; the Duke Forest, comprising 8,300 acres of woodland

adjacent to the West Campus; the field station for the study of animal behavior and ecology; and the Duke University Marine Laboratory, an interdepartmental facility located on a small island on the coast at Beaufort, North Carolina, where twenty-two buildings and a small flotilla of ships and boats provide teaching and research facilities for resident graduate students and faculty as well as visiting individuals or groups.

Duke University, through the botany and zoology departments, is a member institution of the Organization for Tropical Studies, Inc., a consortium of universities with field station facilities in Costa Rica that provide opportunities for course work and research in tropical science.

**Highlands Biological Station.** Duke University holds a contributing membership in the Highlands Biological Station at Highlands, North Carolina, on the southern edge of the Blue Ridge Mountains at an elevation of 4,118 feet. The station and the region offer an excellent opportunity for field studies and some laboratory work. A limited number of qualified students in botany and zoology may make arrangements to carry out research here. Scholarships for advanced study during the summer months are available through the station.

For further information contact Dr. M. D. Rausher, Department of Zoology, or Dr. N. L. Christensen, Department of Botany, Duke University, Durham, North Carolina 27706.

**The Phytotron.** The phytotron, a national environmental control facility operated for the National Science Foundation, is adjacent to the Biological Sciences Building and is administered by the botany department. The phytotron is an integrated series of plant-growth rooms, chambers, and greenhouses, with forty-six separately controlled environments providing more than 4,000 square feet of plant-growing space. The factors of the environment controlled in the units to study plant growth include light, temperature, nutrients, carbon dioxide concentration, and humidity. By using the conditions in various day and night combinations, an exceptionally large number of environments can be simulated for testing the growth responses of plants. The phytotron also includes research laboratories and facilities for studying and monitoring the physiological processes of plants.

Research space in the phytotron is available to graduate students and faculty at Duke and to members of other educational and research organizations. For information concerning the rental of research space, contact Dr. Boyd R. Strain, Director of the Phytotron, Department of Botany, Duke University, Durham, North Carolina 27706.

**Duke Forest.** The Duke Forest comprises approximately 8,300 acres of land in five major divisions and several smaller tracts. A ten-minute walk from campus will take one well into many parts of the Durham Division, and a network of roads and fire trails make almost all areas of the forest easily accessible.

The forest lies primarily in Durham and Orange counties, near the eastern edge of the piedmont plateau, and supports a cross-section of the woodlands found in the upper coastal plain and lower piedmont of the Southeast. A variety of timber types, plant species, soils, topography, and past land use conditions are represented. Elevations range from 260 to 760 feet. Soils of the region are derived from such diverse parent materials as metamorphic rock of the Carolina slate formation, granite, Triassic sedimentary rock, and basic intrusives.

The forest serves for research in such areas as forestry, zoology, botany, and ecology by faculty and students at Duke and neighboring universities. Background information useful to researchers covers such features as soils, topography, inventory, plantation and cultural records, as well as a bibliography of past and current studies. Current work on problems associated with developmental pressures at the urban-rural interface and integrated approaches to natural resource management have multiplied the value and benefit of the forest. For information contact: Judson Edeburn, Duke Forest Resource Manager, Room 206-A Biological Sciences Building, Duke University, Durham, North Carolina 27706.

**Forestry Sciences Laboratory.** The Forestry Sciences Laboratory of the USDA Forest Service, Southeastern Forest Experiment Station is located in the Research Triangle Park near Durham. This research organization provides excellent opportunities to complement research conducted by students in the School of Forestry and Environmental Studies. Specialized research projects in timber investment opportunities, market efficiency, forest soils, insect toxicology, air pollution impacts, and the economics of forestry in developing countries are currently under way at the laboratory. The staff of the laboratory is available for consultation and participation in seminars. Arrangements may be made for students to conduct certain aspects of their research at the laboratory.

**Marine Laboratory.** The Duke University Marine Laboratory (DUML), an interdepartmental training and research facility of the University, is located on Pivers Island, adjacent to the historic seacoast town of Beaufort, North Carolina. Because of the richness and diversity of the area's flora and fauna (including direct access from the laboratory to the open ocean, Cape Lookout National Seashore Park, the Outer Banks, estuaries, sand beaches, wetlands, and coastal forests), the laboratory provides an excellent opportunity for marine study and research. The laboratory accommodates nearly 3,700 visitors per year, including fifteen to twenty resident graduate students who are involved in year-round activities. (For additional information concerning the graduate program, refer to the section on marine sciences in the chapter "Courses of Instruction" in this bulletin and the current *Bulletin of Duke University: Marine Laboratory*.) The physical plant consists of twenty-three buildings, including classroom laboratories, six research buildings, four dormitories, a maintenance complex, and a dining hall. The laboratory has skiffs, a 50-foot training vessel, the R/V *First Mate*, and a new 135-foot research and training vessel, the R/V *Cape Hatteras*, which is operated by the Duke/UNC Oceanographic Consortium.

For information concerning teaching and research space, write to the Personnel and Auxiliaries Office, Duke University Marine Laboratory, Beaufort, North Carolina 28516.

**Zoology Field Station.** The Zoology Field Station, located less than one mile from campus, provides facilities for the study of penned, free-ranging, and caged animals in a protected wooded area of eighty acres. These facilities include soundproofed observation chambers, barns, aviaries, pens for large animals and birds, and two ponds. For information regarding research space, write to Dr. Mark D. Rausher, Department of Zoology, Duke University, Durham, North Carolina 27706.

**Primate Center.** The Duke University Primate Center is located in the Duke Forest about two miles from the main campus. The colony is composed of approximately 730 prosimian primates representing six families, fourteen genera, twenty-five species, and thirty-three varieties. This is both the largest and most diversified colony of living lower primates in the world and the world's largest conservation center for primates. The center also houses frozen, preserved, and fossil primate collections. These collections and animals are utilized by faculty members and both graduate and undergraduate students in the Departments of Biological Anthropology and Anatomy, Forestry, Geology, Psychology, and Zoology for all qualified researchers in primate paleontology, prosimian aging, locomotion, cytogenetics, comparative anatomy, behavior, and physiology. Applications for graduate study in one of these areas should be directed to the Director of Graduate Studies of any of the five departments. For information pertaining to the use of the Primate Center, graduate studies, or availability of research space, write to Dr. Elwyn L. Simons, Director, Duke University Primate Center, 3705 Erwin Road, Durham, North Carolina 27705.

**The Vivarium.** The vivarium facilities are maintained solely to support research and teaching programs of Duke University. The central vivarium contains forty-four animal housing rooms, four sterile operating rooms, two necropsy rooms, ten project rooms, and a diet kitchen. Presently, Duke medical students and physician's associate students attend classes in animal surgery at the vivarium. A farm facility also is available to accom-



moderate dog kennels and large farm animals. The vivarium is staffed by veterinarians, technicians, and caretakers to assure humane care and treatment of animals. The vivarium is fully accredited by the American Association of Laboratory Animal Care which assures compliance with standards of NIH.

**Psychology Laboratories.** The facilities of the Department of Psychology include sound-attenuating and electrically shielded rooms, some for use with human subjects and others for use with animal subjects; rooms for computer-controlled experiments in human perception, memory, and language; electrophysiological recording rooms; and interconnected rooms to provide observation, communication, and videotaping capabilities for the study of social interactions and for the study of personality and clinical processes.

As well as such specially designed spaces, there is a variety of support facilities. To aid in the study of animal behavior and psychobiology, there are a breeding colony of ring doves and colonies of pigeons, rats, and mice. To aid in physiological research, there are surgeries, histology laboratories, and photographic darkrooms. To aid in data collection and analyses, for both human and animal experiments, there are facilities for microprocessor-controlled experiments and videotaping in a variety of situations, including special facilities for the study of operant conditioning, perception, and behavioral ecology.

Several laboratories have independent computers, some with graphics capabilities, and there are direct connections to the large-scale computers at the Triangle Universities Computation Center. There are also fully equipped machine, woodworking, and electronics shops staffed by full-time technicians. Additional facilities for research and teaching are available in the laboratories and clinics of the adjacent Duke Medical Center, in the Veterans Administration Medical Center nearby, and in the universities and research companies in the area.

A number of clinical installations for adults and children, specializing in clinical and guidance problems, cooperate with the department in providing facilities for research and training. Clinical research is often conducted at the Duke Psychology Clinic operated by the clinical psychology program. This facility offers a full range of clinical services to adults, children, and families.

**Chemistry Laboratories.** The Department of Chemistry is housed in the Paul M. Gross Chemical Laboratory. This well-equipped modern chemical laboratory provides conditions very conducive to research. In-house nuclear magnetic resonance facilities include Varian XL-300, IBM NR-80, JEOL 60 and 90 multinuclear FT-NMR spectrometers, and several routine proton instruments. The University NMR center, of which chemistry is a part, also includes GE GN-500 and GN-300 (wide bore) spectrometers. An ESR spectrometer, a Varian E-9, provides excellent facilities for research in electron spin resonance. Mass spectrometric service is provided by two Hewlett-Packard GC-MS systems, as well as access to other HR-MS instruments located in the Research Triangle area. X-ray diffraction cameras of all types are available, along with Enraf-Nonius automatic and Picker automatic full-circle diffractometers. Numerous instruments of varying sophistication for photoacoustic, fluorescence, infrared, U.V., and ORD-CD spectroscopy are available. Several preparative and analytical gas and liquid chromatographs are also located in the building. Computing facilities in the Department of Chemistry include a cluster of twelve IBM personal computers and a cluster of five remote job entry terminals which utilize an IBM Series 1, WIDJET system to access the dual IBM 370/165-Amdahl systems of the Triangle Universities Computation Center via a 19 Kb microwave link. The department also houses a DEC 11/42 system (1 Mbyte, 16 terminal) which operates in a multiuser FORTRAN environment emphasizing computer graphics as a training tool. An AED 512 color graphics/imaging terminal is also available. Numerous other computers are associated with specific research groups. The department has a machine shop and an electronics shop. The facilities of the Duke University Marine Laboratory on the coast at Beaufort,



North Carolina, are available for specimen and water collecting; joint research projects with members of the resident staff have been conducted in the areas of biological chemistry and chemical aspects of oceanography. The Department of Chemistry Library, with holdings of approximately 42,000 volumes, is also located in the Paul M. Gross Chemical Laboratory. The library receives 600 current scientific serial publications and has a terminal facility for complete information retrieval.

**Physics Laboratories.** The Physics Building houses research and instruction in the Departments of Physics and Mathematics. Additional space is provided by the adjacent Nuclear Laboratory Building. Graduate students in the two departments usually have offices in these buildings.

About half of the physics space is devoted to research laboratories for the department's programs. Special equipment includes: microwave facilities operating at high frequencies (1000 GHz and beyond); picosecond, dye, carbon dioxide, and far infrared lasers; a high-resolution 3 MeV Van de Graaff accelerator; a 16 MeV tandem Van de Graaff accelerator with cryogenically-cooled polarized targets; a helium liquefier, cryostats, magnets, and associated equipment for research in the millikelvin temperature range; VAX computers for data collection and processing in nuclear physics and in high-energy physics; various minicomputers and microcomputers in the research groups; and a Sun minicomputer for general departmental use.

The Mathematics-Physics Library is located in the Physics Building; it contains a large selection of books and scholarly periodicals. Also located in the building are instrument and electronics shops, staffed by instrument makers and electronics technicians.

**Engineering Research Laboratories.** The laboratories of the four departments of the School of Engineering contain extensive basic equipment that may be applied in several specialized fields. The facilities available for instruction and research are suggested by the following brief listing of equipment found in each department:

*Biomedical Engineering.* Ultrasound imaging and transducer laboratories; cellular electrophysiology and neurophysiology instrumentation; stereomicroscope, micromanipulators, stimulators, isolation units, and microelectrode puller; facilities for studying biomedical materials and surface interactions; polarizing microscope, internal reflectance infrared spectrophotometer, and dialyzers; soft tissue creep and relaxation test system; biocellular material testing equipment; quantitative videomicroscopy, laser fluorescence microscopy, and nanogram-level micromechanical testing equipment; microprocessor development systems; microprocessor data acquisition and control systems; cardiorespiratory measurements; respirator; and a VAX 11/780 and several PDP-11 and IBM digital computers.

*Civil and Environmental Engineering.* Well-equipped research laboratories are available for work in environmental engineering, soil mechanics and geotechnical engineering, solid mechanics and materials engineering, structural mechanics and structural engineering, fluid mechanics, water resources, and urban systems and transportation engineering. Available research facilities include four independent closed-loop electrohydraulic dynamic loading systems (MTS) capable of applying pulses of any shape and controlled in force or displacement modes, frequency range up to 100 Hz, load capacity 6,000, 35,000, 50,000, and 220,000 lbs. (the 6,000 lbs. actuator can develop a constant cross-head speed up to 50,000 in./min.); equipment for fabricating specimens of and testing fiber-reinforced polymer composites; environmental chamber for testing in the temperature range of -320 to 500; ultra-high-pressure triaxial shear apparatus for confining pressures up to 100,000 psi; rock-testing facilities; model-testing equipment for anchored walls and penetrometer studies; a large-aperture research polariscope; a reflective photoelastic polariscope; sustained-loading facility for long duration in studies of prestressed concrete; wet and dry environmental laboratories equipped to analyze a range of physical, chemical, and biological processes; a fully integrated resource recovery pilot plant; calorimetry for the measurement of heating values of secondary fuels; air classifiers



interfaced with computer readout; several microcomputers, including personal computers with graphics capability; and access to the extensive computer facilities of the Duke University Computation Center as well as the Triangle Universities Computation Center.

The research facilities in water resources are located both indoors and outdoors. Indoors, the laboratory houses flow-measurement devices (flumes, Venturi meters, manometers, etc.) and digital computation hardware. A dual capability teletype terminal is hardwired to a Data General 32-bit MV/20000 computer supported by three-dimensional color graphic printers and, through an acoustic coupler, the same terminal can be switched to access an IBM 3081 computer at the Triangle Universities Computation Center, the WATSTORE data base system of the U.S. Geological Survey in Reston, Virginia, or any other computation system connected via telephone lines. Outdoors, the Sarah P. Duke Gardens watershed (about 100 acres on campus) has been instrumented with rain gauges, compound weirs, and liquid-level flow recorders enabling hydrologic simulation and calibration and verification with real data.

*Electrical Engineering.* Digital data processing laboratory equipped with the Data General 32-bit MV/20000 as a multi-user computer operating in a UNIX type environment for interactive design, graphics, computation, and computer-aided engineering; Digital Equipment Microvax work stations for VLSI design; ethernet network for connection to regional, national, and international data networks; Signal Processing Laboratory with Sun workstations; microwave facilities for experimentation up to 35 GHz; robotics with a GE P-50 robot; microprocessor laboratory; Digital Systems Laboratory; solid-state power conditioning laboratories with dedicated computers for controlling instruments, including digital processing oscilloscopes and network and impedance analyzers, and for computer-aided design; clean room and semiconductor nMOS fabrication laboratory for integrated circuits; access to the design, fabrication, and research facilities of the Microelectronics Center of North Carolina; and an ion implanter and MOCVD epitaxial growth system in a III-V compound semiconductor lab at the Research Triangle Institute.

*Mechanical Engineering and Materials Science.* The department has a number of well-equipped laboratories for studies in aerodynamics, acoustics, nonlinear dynamics and chaos, convective heat transfer, computational fluid mechanics and heat transfer, control theory, cell and membrane biomechanics, biochemical and bioprocess engineering, biorheology, polymer engineering, corrosion, electronic materials, physical metallurgy, positron annihilation spectroscopy, product liability and expert systems. Equipment in these laboratories includes a wind tunnel, a scanning electron microscope, a scanning tunneling microscope, spectrometers, a positron annihilation system and diffusion furnace, inverted microscopes, low-light-level video cameras and a photon counter, cell-culture systems, and an anechoic chamber. Other recently acquired equipment includes Mac, Sun, and Micro/VAX computers with high-resolution color graphics terminals, an X-ray generator and diffractometer, a fluorescence microscope, a correlation signal averager, a symbolic computer, a biostat fermenter, and a video signal digital processor.

**F. G. Hall Hypo-Hyperbaric Center.** The F. G. Hall Hypo-Hyperbaric Center contains eight hyperbaric and/or hypobaric pressure chambers used to simulate altitude or deep-sea diving conditions, for the purpose of both experimentation and medical treatments. The interconnected steel chambers can simulate depths of 3,600 feet, or altitude of 155,000 feet, a capability unmatched in the United States. In 1982 a research dive to 2,250 feet set a new world's record. Research of this type has led to the development of safer and faster decompression tables, better breathing mixtures, and improved types of diving equipment together with new treatments for diving accidents and diseases treated with high-pressure oxygen. The laboratory provides opportunities for basic and applied research and for training physicians, postdoctorates, and graduate students in pressure-related medicine and physiology. The program is multidisciplinary with major participation by the Departments of Anesthesiology, Cell Biology, Neurobiology, Medicine, Surgery, and the School of Engineering.

**The Medical Center.** The Medical Center currently occupies approximately 140 acres. The southern portion is contiguous with the main quadrangle of the University and consists of the following: Davison Building, Duke Hospital South, Baker House, Barnes Woodhall Building, Diagnostic and Treatment Building, Ewald W. Busse Building, Eugene A. Stead Building, Clinical Research II, and the Edwin A. Morris Clinical Cancer Research Building.

The northern portion includes the Nanaline H. Duke Medical Sciences Building, Alex H. Sands Medical Sciences Building, Edwin L. Jones Basic Cancer Research Building, Clinical Laboratory and Medical Research Building, Bell Building, Seeley G. Mudd Communications Center and Library, Searle Center for Continuing Education, Eye Center, and Duke Hospital North.

In the western section of the campus are: Research Park Buildings I, II, III, and IV; the Vivarium; the Animal Laboratory Isolation Facility; a new environmental safety building; and a surgical oncology research building.

In the eastern section of the campus are Pickens Rehabilitation Center, Civitan Mental Retardation and Child Development Center, Child Guidance Center, and Trent Drive Hall.





*Student Life*



## Living Accommodations

Duke University has several residential apartment facilities in which single graduate and professional students live. These apartments are available for continuous occupancy throughout the calendar year. All of the apartments are completely furnished by the University. An itemization of furnishings is included with the floor plans sent out in the application packet. Spaces in apartments for single students are provided on an individual basis with each student paying rent per academic term to the University. This method permits students to share apartments with others of their choice. When this is impractical, the Department of Housing Management strives to place persons with similar interests together. Married student housing is not available. Married students should refer to the section entitled Off-campus Housing.

**Town House Apartments.** Town House Apartments, located about three blocks from the main East-West Campus bus line, is a thirty-two-unit complex. These apartments are more spacious than most apartments found on campus or in Durham. Because of its location away from the academic facilities, students find that it offers a change from normal campus life and activities.

Each air-conditioned apartment includes a living room, a master bedroom, a smaller bedroom, a bath and a half, and an all-electric kitchen with a dining area. Spacious closets and storage spaces are provided within each apartment. A swimming pool, located in the center of the complex, is open during the late spring and throughout the summer months.

Occupants must make arrangements with the local utility companies to pay for electricity, gas, and telephone service. These companies usually require a deposit when initial applications for service are made. Utility companies should be contacted prior to arrival as it usually takes several days to obtain service.

**Central Campus Apartments.** During 1975, Duke University completed a 500-unit apartment complex. A swimming pool, located in the center of the complex, is open during the late spring and throughout the summer months. Additional facilities include a pub, convenience store, tennis courts, and basketball courts.

All utilities—water, heat, air-conditioning, and electricity—are provided. Telephones, which are provided in preinstalled locations in each apartment, are serviced through Duke University's Tel-Com telephone service. Central Campus Apartments residents are responsible for having their phones connected.

Efficiency, two-bedroom, and three-bedroom apartments are rented to single students. Efficiency units are very limited in number and are generally not available to new students.

**Modular Homes.** The University owns six prefabricated modular homes which are located one block from the main East-West Campus bus line. The houses, completely furnished, provide more privacy than most apartments.

In addition to having three bedrooms, each home contains a full bath, an all-electric kitchen, a dining area, and a living room. Sliding glass doors in the living room open onto a wooden deck. An outside storage area is provided in addition to spacious closets within the home. Except for the bathroom, kitchen, and dining area, the homes are completely carpeted and paneled.

Residents of the modular homes are responsible for making arrangements with local utility companies for electricity and telephone services.

**Application Procedures.** When students are informed of their acceptance to Graduate School they will also receive a postcard on which to indicate preference for University housing. This postcard should be returned to the Department of Housing Management. Detailed information on the types of accommodations and application forms will be forwarded to the accepted student. Assignment to all University housing is made on a first-apply, first-assigned basis, and it is not guaranteed.

**Off-campus Housing.** The Department of Housing Management maintains a listing of rental apartments, rooms, and houses provided by property owners or real estate agencies in Durham. These listings are available in the department only; during the summer an assistant is available to answer questions and aid students in their attempt to obtain housing off campus. Information on commercial complexes in the Durham area may be obtained by indicating a preference for off-campus housing on the postcard which you will receive with your acceptance notice. Except for assuring that owners sign a statement of nondiscrimination, off-campus property is in no way verified and neither the University nor its agents negotiate between owners and interested parties.

The search for accommodations should begin as soon as possible after acceptance to the Graduate School. A visit of two or three days will allow you the opportunity to make use of the off-campus service and to inspect personally the available facilities.

**Duke University Marine Laboratory.** The Duke University Marine Laboratory, located on Pivers Island, has cottage-type residence halls which are available. Further information may be obtained from the *Bulletin of Duke University: Marine Laboratory*.

## Food Services

Graduate students who wish to eat on campus may participate in Duke University Food Services' innovative food program. The meal plan allows users to select the location, the time, and the type of food service they desire. At the desired operation, select from the offerings at that location and present your Duke card for payment.

*East Court Cafeteria* is located in the East Campus Union Building, and the *Blue & White Cafeteria* is located in the West Campus Union Building. These cafeterias afford customers the opportunity of paying a predetermined price and eating as much as they like. Each cafeteria offers a selection of six or seven entrees, a choice of vegetables, a salad bar, a pasta bar, yogurt bars, a dessert bar, and self-service ice cream.

*Trent Cafeteria*, in the mall on the lower level of Trent Drive Hall, offers a wide a la carte selection, ice cream fountain, and a large salad bar.

The *University Room*, located in the West Campus Union Building on the main level, is open Monday through Friday and serves breakfast, lunch, and a fine selection of steaks, chops, and seafood for dinner.

The *Rathskeller*, in the Bryan Center, offers gourmet burgers, pasta, broiled chicken, Mexican style foods, and salads.

The *Downunder*, located in the lower level of the Gilbert-Addoms Residence Hall, is open evenings and has a wide variety of fast foods.



The *East Campus Dope Shop* is a soda fountain, and the *Pub at Central* serves sandwiches and drinks.

The *Cambridge Inn* has big burgers, deli sandwiches, pizza by the slice, and several brands of draft beer. The *Boyd-Pishko Cafe* is fast food right in the middle of the Bryan Center. It offers breakfast biscuits, danish, donuts, and beverages. At lunch it offers burgers, hot dogs, chicken filet sandwiches, ice cream, salads, and beverages.

The *Magnolia Room*, in the East Campus building, is open each evening, Tuesday through Friday. Seating is by reservation only. The *Oak Room*, on the second level of the West Campus Union Building, is a full-service restaurant with a wide variety of lunch- and dinner offerings.

*Arthur's*, located in the Eden's Quad and *The North Central Connection* at Trent Hall are open late evening to provide snack and ice cream fountain service for each of these living groups.

Call *University Catering* for delivery of anything from coffee-break fare to a full meal. Catering arrangements can be made for groups or special occasions.

For more information on the meal plan and to open an account, visit the Auxiliaries Contract Card Office. It is located on the lower level of the West Campus Union Building, Room 024.

## Services Available

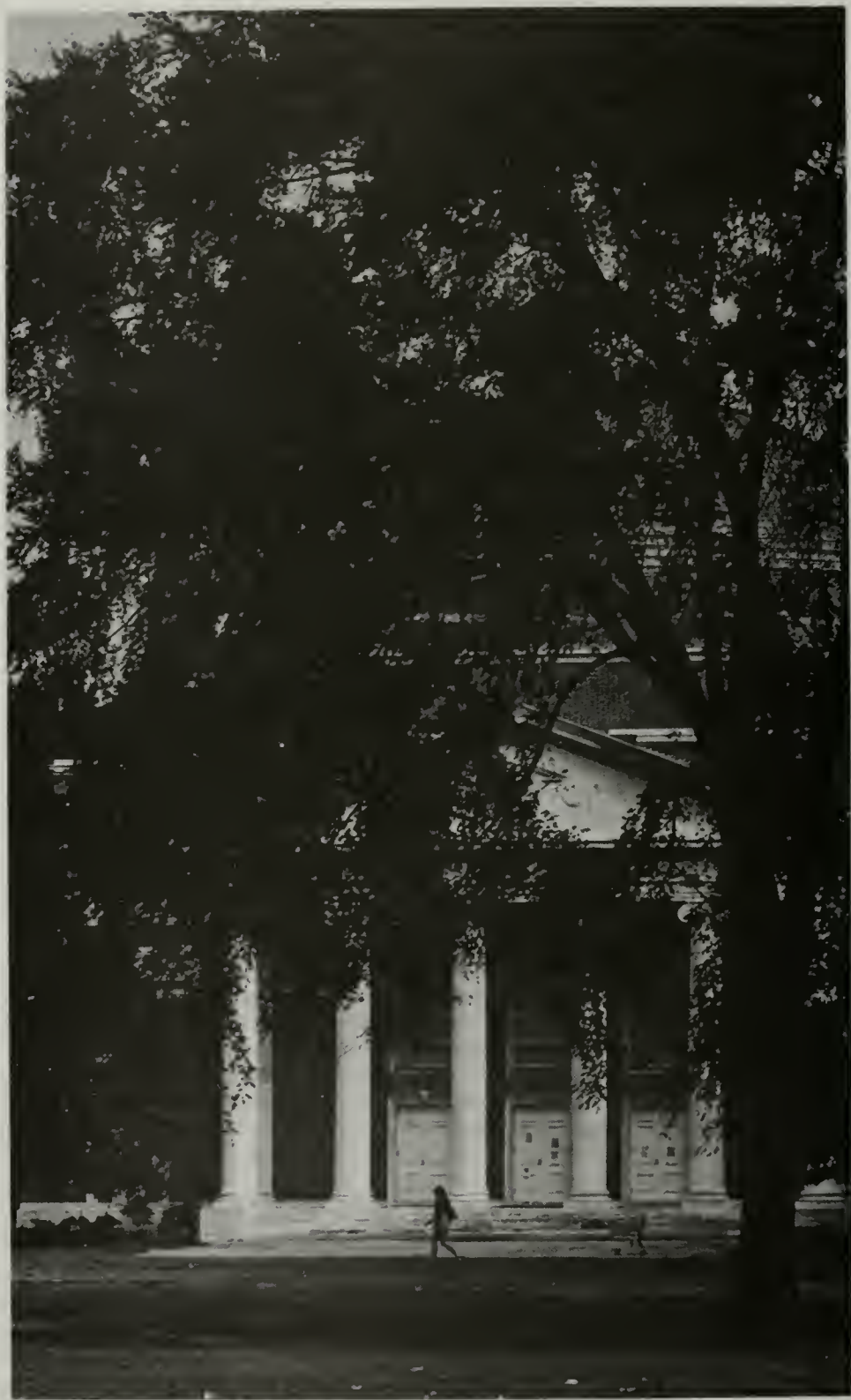
**Medical Care.** The goals of the Duke Student Health Program are to provide comprehensive high quality medical care; to encourage students to make informed decisions leading to healthy lifestyles; and to act as a liaison when students need medical care not available at Student Health.

The components of the Student Health Program include:

1. The Student Health Clinic, located at the Pickens Health Center.
2. The University Infirmary, located on the fourth floor of Duke Hospital, South Division.
3. The Sports Injury Treatment and Prevention Clinic, located in the basement of Card Gym.
4. The Health Education Program, headquartered in the Pickens Health Center and operating campus-wide.

The Student Health Clinic at Pickens is open during both regular and summer sessions, and provides outpatient medical care for a broad range of primary care services, comparable to those available in a large family practice. The Infirmary, which provides for recuperative care requiring bed rest, is open twenty-four hours a day from the start of fall semester through the fall final exams period, and from the start of spring semester through spring graduation day. All currently enrolled full-time students are required to pay the Student Health fee which covers most services offered within the Pickens Health Center, at the Infirmary, at the Sports Injury Treatment and Prevention Clinic, and through Counseling and Psychological Services (CAPS). Information regarding this fee is available from the University Bursar. More information on covered services is available in the Student Health Program and CAPS brochures.

In addition to the Student Health Program, the resources of other services within the Duke University Medical Center are available to all Duke students and their spouses and children; however, charges for any and all services received from the Medical Center other than those covered by the Student Health fee are the responsibility of the student, as are the charges for service received from physicians not associated with Duke University. The Student Health fee does not cover the cost of health care for spouses and dependent children of married students. Coverage of the married student's family can be provided through the University's Student Accident and Sickness Insurance Plan for an additional fee, and clinical services for family members can be provided by Pickens Health Center.



The University has made arrangements for a Student Accident and Sickness Insurance Plan to cover all full-time students for a twelve-month period. For additional fees a student may obtain coverage for a spouse and a child. Although participation in this program is voluntary, the University requires all graduate students to be financially responsible for medical expenses above those covered by the University Student Health Program through the University Accident and Sickness Policy, a private policy, or personal financial resources. Students who have equivalent medical insurance or wish to accept the financial responsibility for any medical expense may elect not to take the Duke plan by signing a statement to this effect. Each full-time student in residence during the fall and spring must purchase this student health insurance or indicate the alternative arrangement. The Student Accident and Sickness Insurance Policy provides protection twenty-four hours a day during the full twelve-month term of the policy for each student insured. Students are covered on and off campus, at home, while traveling between home and school, and during interim vacation periods. The term of the policy begins on the opening day of school in the fall. Coverage and services are subject to change each year as deemed necessary by the University.

All full-time students are enrolled in and charged for the Student Accident and Insurance Policy unless they submit properly completed and signed waivers by the published due date. All foreign students are required to enroll in the University insurance plan or complete the waiver listing the policy number and name of the insurance company providing their comparable coverage. Full payment for student insurance is due at the beginning of the term (insurance may not be paid via payroll deduction). More information on student insurance can be obtained through the office of the Dean of Student Life, or by contacting the Student Health Education Program at 684-6721.

**Counseling and Psychological Services.** Counseling and Psychological Services (CAPS) is a component of student services which provides a comprehensive range of counseling and developmental services to assist and promote the personal growth of Duke students.

The professional staff is composed of psychologists, clinical social workers, and psychiatrists experienced in working with young adults. They provide direct services to students including evaluation and brief counseling/psychotherapy regarding a wide range of concerns. These include issues of self-esteem and identity, family relationships, academic performance, dating, intimacy, and sexual concerns. Ordinarily students are seen for counseling by appointment. If your concern requires immediate attention, a CAPS staff member will assist you with the emergency at the earliest possible time.

Each year CAPS offers a series of self-development seminars and support groups. These explore such interests as stress management, career planning, and management of eating disorders. A special support group for graduate and professional school women is offered most semesters. Interested students may contact CAPS for further information.

CAPS is Duke's center for the administration of national testing programs. Among the number of tests offered is the Graduate School Foreign Language Test (GSFLT).

Another function of CAPS is to provide consultation regarding student development and mental health issues affecting not only individual students but the campus community as a whole. The staff works with campus personnel including administrators, faculty, student health staff, and student groups in meeting needs identified through such liaisons. Staff members are available to lead workshops and discussion groups on topics of interest to students.

CAPS carefully adheres to professional standards of ethics and confidentiality. If a student wants information concerning his/her contact with the CAPS staff released, he/she must sign a specific written authorization.

Initial evaluation and brief counseling/therapy, as well as career and self-development seminars, are covered by the student health fee. There are no additional costs for these



services. If appropriate, referral may be made to other staff members or to a wide variety of local resources.

Appointments may be made by calling 684-5100 between 8:00 A.M. and 5:00 P.M., Monday through Friday. If a student's concern needs immediate attention, that should be made known to the secretary and every effort will be made to arrange for the student to talk with a staff member at the earliest possible time.

**Office of Placement Services.** Duke University maintains an Office of Placement Services which acts as a liaison between the University and potential employers in business and industry, education, and government. The office is located in 214 and 309 Flowers Building.

The staff is available to talk with graduate students about their future professional plans. Students who are eligible to register with the office are offered an opportunity to assemble a complete dossier of academic records and recommendations to support applications for permanent positions and to have a permanent file for future reference. Pertinent recommendations should be accumulated while the student is enrolled at Duke. Interviews with representatives visiting Duke are scheduled during the academic year for students registered with the Office of Placement Services.

All services are offered without charge to Duke students and alumni.

## Student Affairs

**Cocurricular Activities.** Graduate students at Duke University are welcome to use such University recreational facilities as swimming pools, tennis courts, the golf course, and to affiliate with the choral, dance, drama, music, and religious groups. They may become junior members of the American Association of University Professors and may affiliate with Phi Beta Kappa and social fraternities.

A full program of cultural, recreational, and religious activities is presented by the Office of Cultural Affairs, the Duke University Campus Ministry, the Duke University Union, the Office of Student Activities, and recreational clubs. The Duke University Union sponsors a wide range of programs through its committees, which are open to all segments of the campus community. Included are touring Broadway shows; rock, jazz, and pop concerts; speakers; films; a film-making program; the largest fully student-run television station in the country; art exhibits in three galleries; and a broad program in crafts located in Southgate Dormitory and the Bryan University Center. The Aquatic Center and the East Campus Gymnasium pool are available to students, faculty, and staff families. The handball, racquetball, squash, and tennis facilities and the weight room on East and West Campus are also available. Interested students may participate in softball and other team sports.

The University Center complex includes the Bryan University Center, which houses the Information Center, two drama theaters, a film theater, lounges, stores, meeting rooms, games room, the Rathskeller, art gallery, and other facilities; the West Union, which includes dining facilities; and Flowers Building, which includes student publications, Page Auditorium, and the University box office.

Inquiries should be directed to the Recreation Office, 105 Card Gymnasium; the Office of Cultural Affairs, 109 Page Building; Duke Chapel; the Duke University Union, Bryan University Center; or the Office of Student Activities, Bryan University Center.

Full information regarding the scheduling of major events and programs for the entire year will be found in the Duke University *Yearly Calendar*; detailed and updated information for the fall and spring semesters in the *Duke Dialogue*, available each Friday; updated information for the summer session in the *Summer Session Calendar*, published at the beginning of each summer term; and the *Duke Chronicle*, published each Monday through Friday during the fall and spring and each Thursday during the summer. Copies of the Duke University calendars may be obtained at the information desk, Bryan University Center, or the calendar office, Page Building. Also during the summer, the

*Summer Session Calendar* is published weekly by the summer session office and is available at convenient locations.

**Graduate and Professional Student Council.** The Graduate and Professional Student Council is the representative body for the students of graduate departments and professional schools. The council provides a means of communication between schools and between graduate students and the administration. The council selects graduate students for membership on University committees. Representatives of each department and officers of the council are selected annually.

**Religious Life.** The Duke University Chapel, open from 8:00 A.M. until 10:00 P.M., provides a magnificent setting for daily prayer and meditation. In addition, a variety of worship experiences are provided throughout the week including the University service of worship at 11:00 A.M. each Sunday, noonday prayer each weekday during term, and Choral Vespers each Thursday at 5:15 P.M. The 150-voice Chapel Choir is open by audition to all interested singers. The Graduate and Professional Student Fellowship, sponsored by Duke Chapel, provides ecumenical fellowship as well as service opportunities for interested students. Duke Campus Ministry also invites graduate students to participate in the various religious life groups. Contact the office of Minister or Associate Minister to the University, Duke Chapel, for further details.

## Visiting Scholars

The libraries and other facilities of Duke University are made available, to the extent practicable, to faculty members of other colleges and universities who wish to pursue their scholarly interests on the Duke campus. Such visitors are not charged unless they wish to participate in activities for which a special fee is assessed. Inquiries pertaining to visiting scholars should be addressed to the department chairman concerned or the Dean of the Graduate School.

## Postdoctoral Research

Scholars engaged in postdoctoral research often find it advantageous to use the resources of Duke University during the summer. The University welcomes these visitors and makes living accommodations available to them during the summer sessions from May 9 to August 8. Persons desiring research privileges (library and/or laboratory) should request approval through the department in which the research interests lie or through the Graduate School.

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*Marine Laboratory*

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Duke University does not discriminate on the basis of age, race, color, national and ethnic origin, sex, or handicap, in the administration of educational policies, admission policies, financial aid, employment, or any other University program or activity. It admits qualified students to all the rights, privileges, programs, and activities generally accorded or made available to students. For further information, contact Dolores L. Burke, Equal Opportunity Officer (919) 684-8111.

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Joseph Bonaventura and Celia Bonaventura, *Assistant Directors for Marine Biomedical Programs*  
Dianne R. Gagnon, *Business Manager*

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\*On sabbatical leave 1 January-31 December 1989.

†Acting Director 1 January-31 August 1989.

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Stephen A. Wainwright, Ph.D., *Durham, North Carolina*

## Academic Staff

Celia Bonaventura, *Associate Professor of Cell Biology*. Protein structure and function.  
Joseph Bonaventura, *Associate Professor of Cell Biology*. Protein structure and function.  
C. G. Bookhout, *Professor Emeritus of Zoology*. Marine invertebrate embryology and invertebrate zoology.  
Marius Brouwer, *Research Assistant Professor—Marine Laboratory*. Protein biochemistry.  
\* John D. Costlow, *Professor of Zoology*. Marine invertebrate embryology and experimental zoology.  
Richard B. Forward, *Professor of Zoology and Director of Undergraduate Student Affairs, Marine Laboratory*. Physiology of marine animals.  
Donald J. Gerhart, *Research Assistant Professor—Marine Laboratory*. Chemical ecology.  
John Gutknecht, *Professor of Cell Biology*. Membrane physiology.  
Paul J. Hearty, *Research Assistant Professor—Marine Laboratory*. Geological oceanography.  
Thomas C. Johnson, *Associate Professor of Geology and Director of the Duke/University of North Carolina Oceanographic Consortium*. Geological oceanography.  
William W. Kirby-Smith, *Research Associate Professor—Marine Laboratory*. Marine ecology.  
† Orrin H. Pilkey, *Professor of Geology*. Geological oceanography.  
Joseph S. Ramus, *Professor of Botany and Director of Graduate Student Affairs—Marine Laboratory*. Algal ecological physiology.  
Daniel Rittschof, *Research Assistant Professor—Marine Laboratory*. Chemical ecology.  
‡ Richard B. Searles, *Professor of Botany*. Marine phycology.  
J. Bolling Sullivan, *Associate Professor of Biochemistry*. Comparative and evolutionary biochemistry.  
John P. Sutherland, *Associate Professor of Zoology*. Marine ecology.

## Scientific Staff

Robert E. Cashon, *Research Associate*  
Anthony S. Clare, *Research Associate*  
William J. Henley, *Research Associate*  
Bruce E. Kenney, *Research Associate*  
Sonia Ortega, *Research Associate*

## Technical Support Staff

Theodora Brouwer-Hoexum, *Senior Research Technician*  
Gail W. Cannon, *Senior Research Technician*  
Guilia Ferruzzi, *Senior Research Technician*  
Gerald O. Godette, *Senior Research Technician*  
William D. Hunnings, Jr., *Senior Electronics Technician*  
Mary C. Jones, *Research Technician*  
Jacqueline P. Ramus, *Research Technician*  
Alva R. Schmidt, *Senior Research Technician*  
Shirley E. Tesh, *Senior Research Technician*  
Suzanne P. Thompson, *Senior Research Technician*  
Christopher A. Wellins, *Laboratory Technician*

## Support Staff

Cynthia K. Baldwin, *Manager, Personnel and Auxiliaries*  
Joanne Beckwith, *Receptionist/Payroll Clerk*  
L. Thomas Morton, *Head Cook*  
Sylvester Murray, *Assistant Head Cook*  
Bettie E. Tyson, *Food Service Aide*

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\* On sabbatical leave 1 January-31 December 1989.

† Spring only.

‡ Summer only.

Norris A. Hill, *Manager, Physical Plant*  
Clifton W. Davis, *Maintenance Foreman*  
Ellen D. Jones, *Staff Assistant*  
James G. Chadwick, *Grounds Maintenance Mechanic*  
Donald Gagnon, *General Maintenance Mechanic, Certified/Licensed*  
Horace R. Holland, *General Maintenance Mechanic, Senior*  
Johnnie Lupton, *General Maintenance Mechanic, Senior*  
Quentin M. Lewis, Jr., *Captain, R/V First Mate*  
Olive C. Godette, *Housekeeping Supervisor*  
Claudia O. Davis, *Housekeeper Senior*  
Eunice T. Godette, *Housekeeper*  
Mildred E. Tyre, *Housekeeper*

Dianne R. Gagnon, *Business Manager*  
Patricia M. Nolin, *Staff Specialist*  
Susan H. Kenney, *Staff Specialist*  
Sophia D. Turnage, *Staff Specialist*  
Margaret J. Forward, *Artist Illustrator*  
Sue Book, *Secretary, Development*  
Scott D. Taylor, *Photographer*

Mamre M. Wilson, *Staff Assistant*  
Helen E. Nearing, *Word Processor*

Joseph S. Ramus, *Acting Director and Assistant Director for Academic Programs*  
Lilian I. Lorenzsonn-Willis, *Staff Specialist*  
William D. Hunnings, *Electronics Technician Senior*  
Jean S. Williams, *Library Associate*

Joseph Bonaventura and Celia Bonaventura, *Codirectors of the Marine Biomedical Center*  
Belinda B. Williford, *Administrative Assistant*

Joseph F. Ustach, *Executive Officer, Duke/University of North Carolina Oceanographic Consortium*  
Eric B. Nelson, *Marine Superintendent, Duke/University of North Carolina Oceanographic Consortium*  
George A. Newton, *Assistant Marine Superintendent, Duke/University of North Carolina Oceanographic Consortium*  
Dorothy T. Johnson, *Staff Assistant*  
Timothy W. Boynton, *Electronics Technician Senior*  
David L. Bunting, *Draftsman Senior*  
Woody Sutherland, *Computer Technologist*

Richard C. Ogus, *Master, R/V Cape Hatteras*  
Dale H. Murphy, *Chief Mate, R/V Cape Hatteras*  
Larry N. Morris, *Second Mate, R/V Cape Hatteras*  
Jay Venger, *Bosun, R/V Cape Hatteras*  
Lester A. Salter, *Ordinary Seaman, R/V Cape Hatteras*  
Curtis A. Oden, *Deck Engineer, R/V Cape Hatteras*  
Orville G. Weeks, *Chief Engineer, R/V Cape Hatteras*  
Mitchell Dixon, *First Assistant Engineer, R/V Cape Hatteras*  
Robert Lipscomb, *Steward/Cook, R/V Cape Hatteras*  
Byron Boyer, *Cook/Messman, R/V Cape Hatteras*





*General Information*



## **The Beaufort Setting**

The Duke University Marine Laboratory is situated on fifteen acres of Pivers Island, within the Outer Banks of North Carolina, and adjacent to the historic town of Beaufort. Beaufort itself is the third oldest town in the state and is surrounded by fishing and agricultural communities. Cape Lookout National Seashore Park and the Rachel Carson Estuarine Research Reserve are located within easy boating distance of the Marine Laboratory. From the Marine Laboratory, as well as from the Beaufort waterfront and its boardwalk, one can often see feral horses grazing, see egrets or pelicans flying by, or just observe the beautiful natural scenery in its entirety.

## **The Natural Resources for Study and Research**

The area's system of barrier islands, sounds, and estuaries is well-known for its rich flora and fauna, and diverse habitats, including rivers, creeks, mud flats, unspoiled sand beaches, dunes, marshes, peat bogs, cypress swamps, bird islands, and coastal forests, making the area an excellent haven for both nature lovers and those interested in the pursuit of marine science. The area lies within the range of both the temperate and tropical species of biota. The edge of the Gulf Stream oscillates between twenty and thirty miles offshore, with occasional reefs in between. A great variety of phytoplankton, seaweeds, seagrasses, and marshgrasses may be found in the area. Common animals include the blue crab, squid, shrimps, snails, clams, ctenophores, jellyfish, hydroids, sponges, polychaetes, sea urchins, starfish, brittle stars, sand dollars, skimmers, terns, gulls, herons, sea turtles, porpoises, and many species of fish. All provide ample opportunity for study and research and are readily accessible from the Marine Laboratory on foot, by car, or by boat.

## **The Marine Laboratory**

During the 1930s, Dr. A. S. Pearse and colleagues from Duke University were attracted to the site of Pivers Island and its surrounding abundance of marine life for their summer field studies. The site afforded an excellent location for a marine facility and through the subsequent efforts of Dr. Pearse and others, the land was acquired for the Duke University Marine Laboratory. Construction began and by 1938 the first buildings were erected. Originally, the laboratory served only as a summer training and research facility.



The Marine Laboratory has experienced considerable growth since 1938, and today operates year-round to provide training and research opportunities to about 3,000 persons annually, including undergraduate and graduate students enrolled in the laboratory's academic programs, visiting student groups who utilize the laboratory's facilities, as well as scientists who come from North America and abroad to conduct their own research.

The Marine Laboratory is an interdepartmental training and research facility of Duke University, and as such operates under the policies, procedures, and regulations of the University. Each resident faculty member is affiliated with a department of the University. The resident faculty represent the fields of biochemistry, ecology, developmental biology, geology, oceanography, physiology, and systematics.

Pivers Island is only 150 yards across the channel from Beaufort, with a bridge leading to U.S. Highway 70, making the island readily accessible by automobile. Other transportation to the laboratory consists of bus service to Morehead City, about two miles distant from Beaufort and airline service to regional airports (New Bern, Kinston, or Jacksonville).

The modern physical plant consists of twenty-three buildings, including four dormitories, a large dining hall, one residence, boathouse, storehouse for ship's gear, classroom laboratories, six research buildings, and a maintenance complex.

On the Marine Laboratory campus there are recreational facilities for fishing, swimming, rowing, sailing, shuffleboard, basketball, volleyball, and croquet. There are also ample opportunities for recreation in and around Beaufort. The Beaufort area is well-known for its moderate climate, tempered by the Gulf Stream.

The laboratory's year-round seminar/lecture series features many distinguished scientific speakers from across the nation and abroad who help to acquaint both students and fellow researchers with the latest findings in their respective research areas, or present other lectures of a more general nature. Many of the lectures are open to the public as well as to personnel from surrounding marine facilities.

The Beaufort-Morehead City area provides location for five other facilities which collectively are one of the higher concentrations of marine scientists in the nation. These are the University of North Carolina, Institute of Marine Sciences; North Carolina State University, Seafood Laboratory; State of North Carolina, Aquarium—Bogue Banks; State of North Carolina, Division of Marine Fisheries; and the National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Beaufort Laboratory. This concentration of marine scientists provides a critical mass for the pursuit of science and education.

## **THE DUKE/UNIVERSITY OF NORTH CAROLINA OCEANOGRAPHIC CONSORTIUM**

The Oceanographic Consortium operates a 135-foot oceanographic research vessel, the *R/V Cape Hatteras*. The ship operates both on the continental shelf and in the deep sea in the western North Atlantic, concentrating in the region between Nova Scotia and the Caribbean. The ship is a member of the academic research fleet supported by the National Science Foundation for the purpose of providing oceanographic research opportunities to investigators. *R/V Cape Hatteras* is used for training at sea by the five universities that make up the Oceanographic Consortium (Duke, North Carolina State, UNC-Chapel Hill, UNC-Wilmington, and East Carolina). The consortium also manages the acquisition and maintenance of oceanographic instrumentation used aboard *R/V Cape Hatteras*, and promotes annual meetings of marine science staff and graduate students from member institutions. These meetings are held at the Duke University Marine Laboratory.

## THE MARINE BIOMEDICAL CENTER

The National Institute of Environmental Health Sciences (NIEHS) provides support to the Duke University Marine and Freshwater Biomedical Sciences Center with the objective of promoting research in the marine sciences relevant to problems of environmental health. The research goals of this Duke Center are to gain an understanding of the mechanisms involved in the adaptation of man and other organisms to an environment that is both hostile and continually changing. Emphasis is on the biochemical and biological impact of organic and metallic pollutants and the use of marine and freshwater organisms as models.

Studies at the center concern: (1) the effects of chemical pollutants on respiratory proteins and electron transport proteins; (2) the effects of metal and nonmetal pollutants on larval development of various invertebrates; (3) pollutant toxicology using blood as a model organ; (4) behavioral aspects of pollution of estuarine and marine systems; (5) the role of metal and nonmetal pollutants in processes associated with animal, plant, and artificial membrane systems; and (6) effects of heavy metals on ion transport phenomena and cellular membrane potentials. Feasibility studies are conducted to explore the advantages of various experimental approaches and to encourage innovative research.

## The Beaufort Experience

The Marine Laboratory is an academic community and the self-sufficient nature of its residential life serves well those who come here to study or to conduct research. The academic programs are limited to fifty students per regular academic semester or summer term (spring, summer, or fall), making for small group learning. Although recreational opportunities are ample, the distractions are limited, allowing both student and researcher to become totally involved in the pursuit of marine science. Both students and researchers alike find that the Marine Laboratory has an invitingly open, friendly, and relaxed atmosphere which draws many back year after year. This community feeling, as well as the potential for total immersion, has become part of what has been termed "The Beaufort Experience."

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*Academic Programs*





## 1989 Duke University Marine Laboratory Calendar

PROGRAM	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
SPRING	████████████████████ (Jan. 12-May 6)											
CUPMS <sup>1</sup>				██████████ (April 3-May 13)								
SUMMER	I				██████████ (May 15-June 16)							
	II					██████████ (June 19-July 21)						
	III						██████████ (July 24-Aug. 25)					
FALL					(Aug. 28-Dec. 16)				████████████████████			
<sup>1</sup> Cooperative Undergraduate Program in Marine Science												

*The academic programs and curricula listed herein may be subject to change.*

### Academic Programs

In today's competitive world, students seek education not only for self-enrichment, but also for career enhancement. Marine studies can fulfill both needs. The orderly exploitation of the earth's remaining frontier, the oceans, not only requires marine scientists, but increasingly requires legal, business, and political leaders who understand the oceans. Exploration and research must now be complemented by development, regulation, and litigation.

Over the last fifty years, more than 4,000 students from over 300 schools have taken courses at the Duke University Marine Laboratory (DUML). Thousands more have used our laboratory facilities for field trips.

The fall and spring semester programs are open to qualified juniors and seniors from any college or university. Before attending DUML for a semester program, it is advised that a student has completed the following introductory college courses: mathematics, biology, chemistry, and physics.

In our three-term summer program, the wide variety of courses offer choices for both science and nonscience majors. Some courses have no prerequisites and others are intended for advanced majors.

Graduate students may also participate in the fall, spring, or summer program. The 200-level courses are intended for graduate/advanced undergraduate students.

Our Cooperative Undergraduate Program in the Marine Sciences (CUPMS), taught in the spring, has been developed specifically for students whose school calendar is different from that of Duke. This six-week intensive program is intended for science students in their junior or senior year.

The following courses fulfill specific requirements for Duke degree candidates in the majors of zoology and biology (A.B. and B.S.):

- |                                       |  |
|---------------------------------------|--|
| 1. Zoology 76L (Fall)                 | Fulfills animal diversity requirement  |
| 2. Zoology 176L (Summer I)            | Fulfills animal diversity requirement and zoology lab requirement                            |
| 3. Zoology 274L (Summer III)          | Fulfills animal diversity requirement and zoology lab requirement                            |
| 4. Zoology 150L (Spring and Summer I) | Fulfills physiology option or can be taken as an elective if ZOO 151L has already been taken |
| 5. Zoology 169L (Fall)                | Fulfills ecology option; cannot be taken if ZOO 103L has already been taken                  |
| 6. Zoology 203L (Summer II)           | Fulfills ecology option or can be taken as an elective if ZOO 103L has already been taken    |

All other 100- and 200-level zoology and botany courses and 200-level geology courses count as electives within the botany, biology, and zoology major.

## Spring Semester—Undergraduate Marine Sciences Program

12 January-6 May 1989

A full study list ordinarily is four (4) course credits. The curriculum consists of the courses below.

**Biological Oceanography.** (Botany 114L or Zoology 114L.) Physical, chemical, and biological processes of the oceans, emphasizing special adaptations for life in the sea and factors controlling distribution and abundance of organisms. Laboratory emphasis. Prerequisite: introductory biology. One course (4 s.h.\*). *Ramus*

**Physiology of Marine Animals.** (Zoology 150L.) Environmental factors, biological rhythms, and behavioral adaptations in the comparative physiology of marine animals. (Fulfills Duke physiology option, or can be taken as an elective if Zoology 151L has already been taken.) Prerequisites: introductory biology and chemistry. One course (4 s.h.). *Forward*

**Beach and Island Geological Processes.** (Geology 196S.) Processes affecting evolution of beaches and barrier islands with emphasis on the effect of construction. Half course (2 s.h.). *Pilkey*

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\* Semester Hour(s) = s.h.

**The Ecology of Chemical Signals.** (Zoology 296S.) Pheromone communication, predator-prey interactions, chemical warfare, resource location. An experimental and mechanistic study of chemically mediated behaviors central to marine ecology. Half course (2 s.h.). *Rittschof*

**Experimental Ecology of the Marine Intertidal Zone.** (Zoology 296S.) Reading and discussion of papers published since about 1960. Half course (2 s.h.). *Sutherland*

**Independent Study.** (Botany 192, Geology 192, Geology 195, or Zoology 192.) For seniors and juniors with consent of the appropriate Director of Undergraduate Studies and the supervising instructor. One course (3-4 s.h.). *Staff*

## COOPERATIVE UNDERGRADUATE PROGRAM IN THE MARINE SCIENCES

3 April-13 May 1989

During the late spring, the Duke University Marine Laboratory offers an intensive six-week program on the marine environment to students from institutions which have no marine laboratory facilities.

Lectures in the program cover the physical, chemical, geological, and biological aspects of the marine environment with emphasis on the ecology of marine organisms. Numerous field trips are made to estuarine and near-shore habitats which involve environmental measurements, identification of plants and animals collected, and discussion with emphasis on morphological, physiological, and ecological adaptations to the particular habitat. Students do independent research, read original research papers, give oral reports on relevant topics, and submit written reports on laboratory and field work.

**NOTE: Summer tuition scholarships available; see section on Financial Assistance.**

## First Summer Term

15 May-16 June 1989

**Marine Biology.** (Biology 10L.) Physical and chemical characteristics of marine ecosystems and the functional adaptations of marine organisms to these systems. Lectures, field trips, and laboratories. For students not majoring in a natural science. One course (4 s.h.). *Kenney*

**Biological Oceanography.** (Botany 114L or Zoology 114L.) Physical, chemical, and biological processes of the oceans, emphasizing special adaptations for life in the sea and factors controlling distribution and abundance of organisms. Laboratory emphasis. Prerequisite: introductory biology. One and one-half courses (6 s.h.). *Staff*

**Physiology of Marine Animals.** (Zoology 150L or Zoology 250L.) Environmental factors, biological rhythms, and behavioral adaptations in the comparative physiology of marine animals. (Fulfills Duke physiology option, or can be taken as an elective if Zoology 151L has already been taken.) Prerequisites: introductory biology and chemistry. One course or 4 graduate units (4 s.h.). *Forward*

**Marine Invertebrate Zoology.** (Zoology 176L.) Structure, functions, and development of invertebrates collected from estuarine and marine habitats. Not open to students who have taken Zoology 76L or 274L. (Fulfills Duke animal diversity requirement and zoology lab requirement.) Prerequisite: introductory biology. One and one-half courses (6 s.h.). *Kirby-Smith*

**Independent Study.** (Botany 191 or Zoology 191.) For senior and junior majors with permission of the appropriate director of undergraduate studies and the supervising instructor. Course credit to be arranged. *Staff*



**Research.** (Botany 359.) Individual investigation in the various fields of botany. Credit to be arranged. (For graduate students only.) *Staff*

**Research.** (Zoology 353.) To be carried on under the direction of the appropriate staff members. Hours and credit to be arranged. (For graduate students only.) *Staff*

## Second Summer Term

19 June-21 July 1989

**Behavioral Ecology.** (Zoology 113L or Zoology 213L) How ecological factors shape foraging, mating, aggressive, and social behavior. Laboratory experiments and field observations from the Outer Banks environment. Independent projects and seminars. Zoology 113L not open to students who have taken Zoology 213L. Prerequisite: introductory biology. One course or 4 graduate units (4 s.h.). *Rubenstein (visiting summer faculty)*

**Biology of Marine Macrophytes.** (Botany 116L or Botany 216L.) Physiology and ecology of seaweeds, seagrasses, marshgrasses, and mangroves. Biological flux of carbon and nutrients in coastal seas. Ecological consequences of photosynthetic adaptations. Prerequisites: introductory biology and chemistry. One course or 4 graduate units (4 s.h.). *Ramus*

**Marine Policy.** (Public Policy Studies 195S.) Formal study of policy and policymaking regulating the exploitation of the marine environment. History of specific marine-related organizations, legislation, and issues are traced and their effects on local, regional, national, and international arenas. Topics explored through use of theoretical and methodological perspectives, including political science, sociology, and economics. Lectures, including seminar presentations by visiting marine policymakers and policy analysts. Major emphasis is national in scope; some examples from North Carolina and the Mid- and South Atlantic areas. One course (3 s.h.). *Orbach (visiting summer faculty)*

**Marine Ecology.** (Zoology 203L.) Application of ecological theory to marine systems. Emphasis on hypothesis formulation, field experimentation, data analysis, scientific writing, and familiarity with current ecological literature. (Fulfills Duke ecology option, or can be taken as an elective if Zoology 103L has already been taken.) Prerequisite: a course in introductory ecology, invertebrate zoology, or marine botany (phycology); knowledge of statistics helpful. One and one-half courses or 6 graduate units (6 s.h.). *Hay (visiting summer faculty)*

**Barrier Island Ecology.** (Botany 218 or Forestry and Environmental Studies 218.) Adaptation of plants to barrier island migration and other physical characteristics of the coastal environment. Major emphasis on management of barrier beaches from Maine to Texas and the impact of human interference with natural processes. Field studies. Prerequisite: course in general ecology. One and one-half courses or 6 graduate units (6 s.h.). *Evans, Peterson, and Wells (visiting summer faculty)*

**Benthic Marine Algae.** (Botany 219L.) Morphology, reproduction, life histories, systematics, and natural history of seaweeds. Lectures, laboratories, and field work in ocean and estuaries. Prerequisite: introductory biology; plant diversity recommended. One course or 4 graduate units (4 s.h.). *Searles*

**Independent Study.** (Botany 192 or Zoology 192.) For senior and junior majors with permission of the appropriate director of undergraduate studies and the supervising instructor. Course credit to be arranged. *Staff*

**Research.** (Botany 360.) Individual investigation in the various fields of botany. Credit to be arranged. (For graduate students only.) *Staff*

**Research.** (Zoology 354.) To be carried on under the direction of the appropriate staff members. Hours and credit to be arranged. (For graduate students only.) *Staff*

## Third Summer Term

24 July-25 August 1989

**Marine Biology.** (Biology 10L.) Physical and chemical characteristics of marine ecosystems and the functional adaptations of marine organisms to these systems. Lectures, field trips, and laboratories. For students not majoring in a natural science. One course (4 s.h.). *Kenney*

**Marine Invertebrate Zoology.** (Zoology 274L.) Structures, functions, and habits of invertebrate animals under natural and experimental conditions. Field trips. (Fulfills Duke animal diversity requirement and zoology lab requirement.) Not open to undergraduate students who have taken Zoology 76L or 176L. Prerequisite: introductory biology. One and one-half courses or 6 graduate units (6 s.h.). *Ruppert (visiting summer faculty)*

**Invertebrate Developmental Biology.** (Zoology 278L.) Gametogenesis, fertilization, and development of invertebrates, with emphasis on experimental studies of prelarval stages. Prerequisite: consent of instructor. One and one-half courses or 6 graduate units (6 s.h.). *Staff*

**Continental Margin Sedimentation.** (Geology 295S.) Sediment composition and distribution on the continental margin, with emphasis on North Carolina barrier island/lagoon, shelf and slope environments. The course includes field work and laboratory analyses of sediments as well as readings and discussion of the current literature. (**Offered alternate years; not offered during 1989.**) Prerequisite: Geology 205S or Geology 206S or consent of instructor. One course or 4 graduate units (4 s.h.). *Johnson and Wells (visiting summer faculty)*

**Independent Study.** (Botany 191 or Zoology 191.) For senior and junior majors with permission of the appropriate Director of Undergraduate Studies and the supervising instructor. Course credit to be arranged. *Staff*

**Research.** (Botany 359.) Individual investigation in the various fields of botany. Credit to be arranged. (For graduate students only.) *Staff*

**Research.** (Zoology 353.) To be carried on under the direction of the appropriate staff members. Hours and credit to be arranged. (For graduate students only.) *Staff*

## Fall Semester—Undergraduate Marine Sciences Program

28 August-16 December 1989

A full study list ordinarily is four (4) course credits. The curriculum consists of the courses listed below.

**Marine Invertebrate Diversity.** (Zoology 76L.) Form, function, and evolution of invertebrates from estuarine and coastal habitats. Laboratory study of perception, feeding, digestion, respiration, locomotion, reproduction, and development. Field study of adaptations to natural environments. (Fulfills Duke animal diversity requirement.) Not open to students who have taken Zoology 176L or 274L. Prerequisite: introductory biology. One course (4 s.h.). *Kirby-Smith*

**Marine Sediments.** (Geology 109S or Geology 209S\*) Sedimentary processes in near-shore, shelf and deep-sea environments. Emphasis on field methods and laboratory analyses. (\*Geology 209S: additional requirement of term paper.) One course (4 s.h.). *Johnson*

**Organization of Marine Communities.** (Zoology 169L.) Dynamics of marine communities in the context of current ecological theory. Life history strategies, competition, predation, diversity, and stability; detailed considerations of benthic and pelagic communities. (Fulfills Duke ecology option.) Students may not receive credit for both Zool-

ogy 103L and 169L. Prerequisites: introductory biology and mathematics. One course (4 s.h.). *Sutherland*

**Light in the Sea.** (Botany 195S.) Properties of light in the sea and the biological consequences; orientation, bioluminescence, biological rhythms, primary production, and sensing devices. Half course (2 s.h.). *Ramus*

**Physical Oceanography.** (Geology 203.) Physical processes in the oceans: the physical properties of seawater, the dynamics of currents, waves and tides, and the transmission of light and sound in the sea. Prerequisite: Physics 41 or 51. Half course (2 s.h.). *Johnson*

**Marine Animal Navigation.** (Zoology 295S.) Orientation to visual, chemical, mechanical, and magnetic cues. To examine aspects of the cues used for navigation, behavior involved, functional significance, and experimental design. Half course (2 s.h.). *Forward*

**Independent Study.** (Botany 191, Geology 191, Geology 195, or Zoology 191.) For seniors and juniors with consent of the appropriate Director of Undergraduate Studies and the supervising instructor. One course (3-4 s.h.). *Staff*

## Graduate Program

Graduate students from any and all academic disciplines are encouraged to take professional training at the Marine Laboratory. The program operates year-round, providing course work in the marine sciences, an active seminar program, and facilities supporting dissertation research. Resident graduate students represent the Departments of Biochemistry, Botany, Forestry and Environmental Studies, Geology, and Zoology. Ordinarily, dissertation advisers are resident as well, although this need not be the case. The Marine Laboratory has available several full-time instructional assistantships (including summer) as well as endowed fellowships, including the Rachel Carson Graduate Fellowship, the Harvey W. Smith Graduate Fellowship in Biological Oceanography, the Lynde and Harry Bradley Fellowship, and the Robert Safrit Fellowship. In addition, tuition credits obtained from fellowship support may be applied to courses given both at the Marine Laboratory and the Durham campus, regular semesters and summer terms.





Students are admitted to degree programs in regular academic departments, not the Marine Laboratory (consult the current *Bulletin of Duke University—Graduate School* for additional information). Generally, degree requirements, excepting dissertation research, are met on the Durham campus, then students take residence at the Marine Laboratory for dissertation research.

## Marine Sciences Education Consortium (MSEC)

The Marine Sciences Education Consortium (MSEC) was developed to provide a formal curriculum in the marine sciences, including supervised research, to member institutions. Such institutions are liberal arts colleges or universities attended by students who are preparing for careers in the marine sciences or who have a strong liberal arts interest in the oceans but for whom no specialized programs in the marine sciences are available. Duke University has developed the specialized coastal physical plant, vessels, equipment, library, and faculty necessary to implement such programs. MSEC students have access to the spring and fall semester programs in marine sciences as well as the summer program here at the Duke Marine Laboratory, including room/board facilities. Currently, member institutions include Denison University, the Five Colleges Coastal and Marine Sciences Program (Amherst College, Hampshire College, Mount Holyoke College, Smith College, and the University of Massachusetts), Furman University, Gettysburg College, Hood College, Juniata College, Macalester College, Miami University, North Carolina State University, Oberlin College, Presbyterian College, Trinity College, University of Richmond and Wittenberg University.

Members join upon invitation and mutual agreement. Inquiries from interested institutions are welcome and requests to join the MSEC will be considered. Such inquiries should be addressed to the Assistant Director for Academic Programs, Duke University Marine Laboratory, Beaufort, North Carolina 28516.

## Visiting Scholar Programs

The exchange of knowledge is kept lively by several programs which bring distinguished scientists/educators to the Marine Laboratory. The Visiting Scholar Program brings lecturers for a period of several days on a monthly basis year-round. The Cocos Foundation brings visitors for longer periods of time, usually five weeks and only during the summers. The scholars, while in residence, lecture to the community at large as well as enrich specific research groups.

## Requirements and Procedures

**Spring and Fall Semester—Undergraduate Marine Sciences Programs.** During the spring and fall semesters interdisciplinary programs in marine sciences provide an opportunity for undergraduate students to live and study at the Marine Laboratory. The programs are open to qualified junior and senior students. In the case of Duke students, participation in both the spring and fall semesters is possible only with the consent of their departmental adviser.

Duke students can obtain the appropriate application form from the back of this bulletin, the Director of Undergraduate Studies in their major department, or by writing to the Marine Laboratory. On the Durham campus, additional information about the Duke University Marine Laboratory and the academic programs is available from Dean Deborah Roach, 04 Allen Building. Duke students should submit the completed application. Non-Duke students should submit the appropriate application form (contained toward the back of this bulletin), one letter of recommendation from academic faculty, and a current transcript of academic work. All completed applications and supporting credentials, if required, (from all applicants) should be received prior to the preceding 31 October (for spring semester 1989) and the preceding 27 March (for fall semester 1989) by

the Admissions Office of the Marine Laboratory. (Applications received after these dates will be considered on a space-available basis.) Applicants will be notified by mail concerning their admission status.

**Summer Terms.** Introductory level courses (numbered below 100) offered during the summer at the laboratory are open to all qualified college students; advanced level courses (numbered 100 to 199) are intended for undergraduate students from the sophomore to the senior level; senior-graduate level courses (numbered from 200 to 299) are intended for advanced undergraduates and graduate students (juniors and well-qualified sophomores may enroll in these courses with special permission). Undergraduates may not enroll in 300-level courses.

Students apply for all *undergraduate* and *graduate courses* and for *graduate graded research* by submitting the Summer Session application found at the back of this bulletin.

The application and current transcripts (in the case of those who are applying to courses numbered 100 or above) should be submitted by all applicants to the Admissions Office of the Duke University Marine Laboratory as early as possible to allow for adequate processing time and to assure a space in the desired course(s). Late applicants will be considered if space permits. All applicants will be notified by mail as promptly as possible after a decision has been reached concerning their application. Upon acceptance, payment of required deposit(s) is essential to reserve space in a course as well as room and board accommodations.

Students who have had adequate preparation and approval of their major professor may request space for independent or thesis research. Students register for *ungraded graduate research* and *residence only* on *Graduate School course cards* (available from the appropriate director of graduate studies and to be returned to the Graduate School, 127 Allen Building).

**Summer Credit.** The summer session term credit does not mean degree credit at Duke University unless the student has been admitted as a degree candidate by one of the colleges or schools of the University. Other students will be categorized as nondegree (unclassified) students for the summer only. A student taking a course for credit is expected to do all the work required and to take the final examination, and will receive a grade.

**Summer Minimum Enrollment.** Some courses are offered subject to minimum enrollments. In withdrawing a course not having adequate enrollment, every effort will be made to place the student in an alternate course which has been listed by the student as a second choice.

**Summer Maximum Program Load.** The maximum load for one term of the summer session at the Marine Laboratory is a one and one-half course (or 6 graduate unit) program (semester hour equivalents are listed under the course descriptions). A greater load may be possible only with the approval of the student's Dean or the appropriate director of graduate studies. Non-Duke students must obtain approval from the director of the summer session.

**Immunizations.** North Carolina Statute G.S.: 130A-155.1 states that no person shall attend a college or university, public, private, or religious . . . unless a certificate of immunizations against diphtheria, tetanus, whooping cough, poliomyelitis, red measles (rubeola), and rubella is presented to the college or university on or before the first day of matriculation.

Duke students should have already satisfied this provision. Non-Duke students must obtain the required immunizations and present certification that the required immunizations have been received. Certifications must be sent to Director of Student Health Services, Box 2914 DUMC, Duke University, Durham, NC 27710. *Failure to do so will result in the students being withdrawn from classes. There will be no refunds. Non-Duke students have the responsibility for requesting forms from the Marine Laboratory Admissions Office.*

## Financial Information

*Figures quoted in this section are projections in some cases and may be subject to change without prior notice.*

### SPRING AND FALL SEMESTER—UNDERGRADUATE MARINE SCIENCES PROGRAMS

*Tuition and fees for the fall semester are unavailable at the time of this printing.*

**Tuition.** Tuition for the spring semester will be \$5,300. (See also section on payment of tuition and fees.)

**Health Fee.** Students are required to pay \$119 for the spring semester.

**Student Activity Fee.** The student activity fee for the spring semester will be \$57.

**Room and Board.** The total room and board fee for the spring semester will be \$2,035. All dormitory occupants must supply their own linens, blankets, and towels, but pillows will be furnished. A key deposit of \$10 (per semester) will be charged each person occupying a room. This deposit will be refunded at time of departure and return of key.

Full board provides for three meals a day, Monday through Saturday, and breakfast and dinner on Sunday. No credit will be allowed for meals that are missed.

**Estimated Semester Costs.** Estimated costs for the spring semester will be: tuition—\$5,300; health fee—\$119; student activity fee—\$57; room and board—\$2,035. Books, if required by the instructor, will be available at registration.

**Payment of Tuition and Fees.** The Office of the Bursar (Duke University, Durham campus) will issue invoices to registered students for tuition, fees, and other charges approximately four to six weeks prior to the beginning of classes each semester. The *total amount due* on the invoice is payable by the invoice late payment date which is normally one week prior to the beginning of classes. A student is required to pay all invoices as presented. If full payment is not received, a late payment charge as described below will be assessed on the next invoice and certain restrictions will be applied. Failure to receive an invoice does not warrant exemption from the payment of tuition and fees nor from the penalties and restrictions. (Duke University students on other tuition payment plans—see the current *Bulletin of Duke University: Undergraduate Instruction*.) Non-registered students will be required to make payment for tuition and fees (and any past due balance) at the time of registration. Payments should be sent to the address indicated on the invoice and not to the Duke Marine Laboratory.

**Late Payment Charge.** If the *total amount due* on an invoice is not received by the invoice late payment date, the next invoice will reflect a penalty charge of 1 and  $\frac{1}{4}$  percent per month assessed on the past due balance regardless of the number of days past due. The *past due balance* is defined as the previous balance less any payments and credits received on or before the late payment date and also any student loan or scholarship memo credits related to the previous balance which appear on the invoice.

### SUMMER TERMS

**Tuition.** The following are tuition charges for summer registration.

1. Undergraduate students:
  - a. \$1,842 for each one and one-half course (6 s.h.)
  - b. \$1,228 for each undergraduate laboratory course (4 s.h.)
  - c. \$921 for each nonlaboratory course (3 s.h.)
  - d. \$614 for each half-course (2 s.h.)



2. Graduate students:
  - a. \$307 per unit (s.h.)
  - b. For an undergraduate course, the tuition rate indicated in section 1 above is applicable.

#### **Auditing Fees.**

1. With permission of the instructor and the director, students registered for a full program (6 s.h.) may audit courses. No extra charge is made.
2. Students carrying less than a full program (6 s.h.) may be granted permission by the instructor and the director to audit a course, but must pay half the University fee for the course.

**Health Fee.** Students are required to pay \$33 per term.

**Room and Board.** Total charges for room and board are estimated at \$765 per term or higher.

Air-conditioned, as well as a few non-air-conditioned, dormitory rooms are available. (Upon acceptance in a course, students will be sent an acceptance and reservation form. Reservation for housing and board should be made on this form and the form promptly returned to the Marine Laboratory along with the room and board reservation deposit, if the student elects to utilize room and board.)

Occupants must supply their own linens, blankets, and towels, but pillows will be furnished.

Full board provides for three meals a day, Monday through Saturday, and breakfast and dinner on Sunday. There will be no credit allowed for missed meals.

#### **Deposits.**

1. **Course Deposit.** Upon acceptance in a course, a nonrefundable deposit of \$100 (per course) is required to ensure a reservation in that course. If the student properly registers for the course and attends, the deposit will be credited to tuition.
2. **Room and Board Deposit.** A \$50 deposit (per term) is required to ensure a reservation for room and board. If the student properly registers, the deposit will be credited to the room and board charge. The deposit is refundable if a student who has previously made a room and board reservation properly withdraws from a course prior to the beginning of the term. *The deposit is nonrefundable if a student who has previously made a room and board reservation at the Marine Laboratory subsequently decides not to utilize the room and board facilities (although he or she still plans to attend the course) and does not notify the Marine Laboratory at least two weeks prior to the beginning of the term.*
3. **Key Deposit.** A key deposit of \$10 per term will be charged each person occupying a dormitory room. This deposit will be refunded at time of departure and return of the key.

**Estimated Term Costs.** Estimated costs for each of the summer terms will be: tuition—(see tuition section); student health fee—\$33; room and board—about \$765 or higher. Books, if required by the instructor, will be available at registration.

**Payment of Tuition and Fees.** Duke University Marine Laboratory does not mail statements for summer term tuition and fees. All tuition and fees must be paid to the Accounting Office (Duke University Marine Laboratory, Beaufort, North Carolina 28516) on or before the Friday preceding the beginning of each summer term—see Duke University Marine Laboratory calendar for term dates). Checks should be made payable to Duke University Marine Laboratory and may be mailed to the above address. *Failure to pay tuition and fees by the end of the drop/add period (the first three days of classes in any term) will result in administrative withdrawal of the student.* These withdrawn students will be billed the health fee and an administrative withdrawal fee of \$225 (per 6 semester hour course),

\$150 (per 3-4 semester hour course), or \$75 (per 2 semester hour course) and receive a W for each course for which they were registered. Students who, subsequent to withdrawal, clear with the Marine Laboratory Accounting Office may, with written permission of their academic dean, be reinstated in their classes as originally registered and receive regular grades instead of Ws. The administrative withdrawal fee will stand and the student will be liable for full tuition and fees. Students who are unable to meet these deadlines should consult with the Accounting Office and their academic dean (in the case of Duke University students) prior to the deadline.

**Late Payment Charge.** Students who fail to pay all tuition and fees on or before the Friday preceding the beginning of each term will pay an extra charge of \$25.

## TRANSCRIPTS

Requests for transcripts of academic records should be directed to the Associate Registrar, Office of the Registrar, 103 Allen Building, Duke University, Durham, North Carolina 27706. Ten days should be allowed for processing. A fee of \$2, payable in advance, is charged for each copy. Such requests should not be directed to the Marine Laboratory.

## REFUNDS

**Spring and Fall.** In the case of withdrawal from the University, students or their parents may elect to have tuition refunded or carried forward as a credit for later study according to the following schedule:

<i>Withdrawal</i>	<i>Refund</i>
Before classes begin	Full amount
During first or second week	80 percent
During third, fourth, or fifth week	60 percent
During sixth week	20 percent
After sixth week	None

Tuition charges paid from grants or loans will be restored to those funds on the same pro rata basis and will not be refunded or carried forward. In addition to tuition the schedule also applies to other Marine Laboratory fees. In the event of death, a full tuition and fees refund will be granted. Consult the *Bulletin of Duke University—Undergraduate Instruction* for additional information.

**Summer Terms—Drop or Administrative Withdrawal Charges and Refund of Tuition and Fees.** Students who will not be attending a summer term or course for which they have been officially accepted must drop the course(s) prior to the beginning of the term whether or not they have not paid tuition and fees. Students who fail to drop the course(s) prior to the beginning of the term will be charged \$225 (per 6 semester hour course), \$150 (per 3-4 semester hour course), or \$75 (per 2 semester hour course) plus the health fee.

Students who will not be attending a summer term or course for which tuition and fees have been paid are eligible for refunds following these policies:

1. There is no refund of tuition and fees if the student drops a course(s) or withdraws from the term after the third day. After the first week of the term, the room and board fee less the cost of each week of room and board (a week of room and board is considered Sunday-Saturday) is refunded.
2. Full tuition less \$225 (for a 6 semester hour course), \$150 (for a 3-4 semester hour course), or \$75 (for a 2 semester hour course) is refunded if the student officially drops a course(s) or withdraws from the term during the first three days; the room and board fee less the cost of one week of room and board will also be refunded. The health fee is not refunded. (There is no charge for drop/adds that result in no change in course load in the same term).
3. Full tuition and fees are refunded if the student officially drops a course(s) or withdraws from the term before the first day of the term.

## CHECK CASHING

The banks in the Beaufort-Morehead City area have indicated that they will not cash personal checks for students unless they are guaranteed. Therefore, it is recommended that students who come to the laboratory bring with them sufficient travelers' checks, money orders, certified checks (which the banks will cash), or cash to cover personal expenses. The Marine Laboratory will accept personal checks to pay course fees. There is a Wachovia Bank in Beaufort and Morehead City.

## Financial Assistance

### SUMMER TUITION SCHOLARSHIPS AND FELLOWSHIPS FOR UNDERGRADUATE AND GRADUATE STUDENTS

The Bookhout Scholarship, the Deborah Susan Steer Memorial Scholarship in Marine-Life Sciences, the Wade Family Fellowship, and the Harvey W. Smith Undergraduate Fellowship are awarded on a competitive basis by the Duke University Marine Laboratory (DUML). Each award provides tuition for one course taken during the summer. Awards require that the student live on campus, i.e., take room and board at the Marine Laboratory. Undergraduate Independent Study and Graduate Research courses do not qualify for these awards. The criteria which are used in review of scholarship/fellowship applicants include academic excellence, scope of preparation, and professional goals. Selection of awardees will be made by the DUML faculty.

A precondition to review of a scholarship/fellowship application is admission to a specific summer course. (Admission to courses does not automatically imply award of scholarship/fellowship; separate reviews are conducted.)

A separate scholarship/fellowship application form is not utilized. Intent to apply for a scholarship/fellowship should be made known on the reverse of the summer course application located at the back of this bulletin. In addition to the summer application for courses, each scholarship/fellowship applicant is required to submit (1) college or professional school transcript(s), (2) a letter of recommendation from academic faculty, and (3) a brief statement of purpose, i.e., the reason for taking the particular course. *All scholarship/fellowship credentials must be received no later than 30 March 1989 by the Admissions Office of the Marine Laboratory.* Announcement of award will be made by mail shortly after the deadline date.

In addition, the Richard C. and Linda G. Seale Scholarship is intended to provide support to qualified students from Denison University for participation in summer courses at the Duke University Marine Laboratory. Denison University students interested in applying for this scholarship are directed to the Chairman, Department of Biology, at Denison University with respect to required supporting credentials and deadlines for application and award notification. Should there be no applicants from Denison, the scholarship may be used to provide financial assistance to any qualified student.

**Bookhout Scholarship.** The Bookhout Scholarship provides financial assistance to juniors, seniors, or beginning graduate students with a professional interest in the natural sciences.

**Deborah Susan Steer Memorial Scholarship in Marine-Life Sciences.** Each year the income from the fund is used to provide financial assistance to promising Duke undergraduates who wish to study marine life-sciences at the Duke University Marine Laboratory.

**The Wade Family Fund.** The income from this fund is used to support undergraduate and graduate student participation in academic courses. Awards are made at the discretion of the Director of the Marine Laboratory.



**Harvey W. Smith Undergraduate Fellowship in Biological Oceanography.** The income from this fund is used to support undergraduate participation in academic courses.

**Richard C. and Linda G. Seale Scholarship Endowment Fund.** The fund income is used to support qualified Denison University students in academic summer courses at the Duke University Marine Laboratory. In the event that there are no students from Denison who apply or who are qualified for the scholarship, such income may be used to provide financial assistance to any qualified student.

## UNDERGRADUATE FINANCIAL AID

Financial aid is available to Duke University undergraduate students for each summer term. Interested students can obtain specific details and an application from the Financial Aid Office, Duke University, 2106 Campus Drive, Durham, NC 27706 in March of each year.

## FULL-TIME GRADUATE SUPPORT

Full-time (academic year, including summer) graduate support is available to students registered in a graduate program in any department in the sciences at Duke University. Recipients must be in residence at the Marine Laboratory during the period of their appointment and must also conduct, or plan to conduct, their research at the Beaufort campus. Support is available in the form of Duke University Marine Laboratory Instructional Assistantships, the Rachel Carson Fellowship, the Harvey W. Smith Graduate Fellowship in Biological Oceanography, the Lynde and Harry Bradley Fellowship, and the Robert Safrit Graduate Fellowship. Awards will be made annually for a maximum of three years.

Instructional assistantship applicants must submit (1) a letter of recommendation from their major professor and (2) graduate record, including (a) date admitted to the Graduate School, (b) courses completed and grades, (c) dissertation committee, (d) date of qualifying examination, (e) statement of research program. Fellowship applicants must submit (1) a statement of the proposed research for the term of the fellowship, (2) two letters of recommendation, one of which must come from faculty outside of the Duke University Marine Laboratory, and (3) graduate record, including (a) date admitted to the Graduate School, (b) date of qualifying examination, (e) title of dissertation or thesis. *Complete applications for instructional assistantships and/or fellowships must be received by the Assistant Director for Academic Programs before 28 February 1989.*

For further information, write the Assistant Director for Academic Programs, Duke University Marine Laboratory, Beaufort, North Carolina 28516.

**Rachel Carson Graduate Fellowship.** The recipient is expected to conduct research related to some aspect of the Rachel Carson Estuarine Research Reserve.

**Harvey W. Smith Graduate Fellowship in Biological Oceanography.** The recipient must conduct research in biological oceanography.

**Lynde and Harry Bradley Fellowship.** The recipient must conduct research in some aspect of marine science or policy. Awards are made at the discretion of the Director of the Duke University Marine Laboratory.

**Robert Safrit Graduate Fellowship.** The recipient must conduct research in some aspect of marine science. Awards are made at the discretion of the Director of the Duke University Marine Laboratory.

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*Resources for Study and Research*



## Research Staff and Their Programs

**Drs. Joseph Bonaventura and Celia Bonaventura.** Physiological and Biochemical Adaptations of Organisms to the Marine Environment and Marine Biotechnology.

Marine organisms are found in environments characterized by great diversity in temperature, pH, salinity, oxygen availability, etc. Through biochemical studies the structural and functional diversity of these organisms and their environments is being shown to be paralleled by diversity at the molecular level. The respiratory proteins of marine organisms are being studied in order to increase the understanding of molecular adaptations and the mechanisms which give rise to functional flexibility. Investigations include measurements of the kinetics and equilibria of ligand binding to hemoglobins, hemocyanins, and cytochrome *c* oxidase with emphasis on the reactivity of these proteins as regulated by metabolic effectors. The subunit interactions involved in assembly of giant hemocyanin molecules are also under investigation. These studies are complemented by work in the Protein Engineering and Technology Laboratory where properties of chemically modified, crosslinked, and immobilized forms of biologically active molecules are characterized.

Bickar, D.; Lehninger, A.; Brunori, M.; Bonaventura, J.; and Bonaventura, C. 1985. Functional equivalence of monomeric (shark) and dimeric (bovine) cytochrome *c* oxidase. *J. Inorg. Biochem.* 23:365-372.

Johnson, B. A.; Bonaventura, C.; and Bonaventura, J. 1988. *Callinectes sapidus* hemocyanin: Cooperative oxygen binding and interactions with L-lactate, calcium, and protons. *Biochemistry* 27:1995-2001.

Sugihara, J.; Imamura, T.; Nagafuchi, S.; Bonaventura, J.; Bonaventura, C.; and Cashon, R. 1985. Hemoglobin Rahere, a human hemoglobin variant with amino acid substitution at the 2,3-diphosphoglycerate binding site. Functional consequences of the alteration and effects of bezafibrate on the oxygen bindings. *J. Clin. Invest.* 76:1169-1173.

Topham, R. W.; Tesh, S.; Bonaventura, C.; and Bonaventura, J. 1988. Active-site heterogeneity in *Limulus* hemocyanin as revealed by reaction with peroxides. *Arch. Biochem. Biophys.* 261(2):299-311.



**Dr. C. G. Bookhout.** Larval Ecology and Larval Development of Invertebrates.

This laboratory investigates the effects of pollutants, such as insecticides and drilling fluids, on the complete development of mud-crabs and blue crabs. Also, a study of the development of the family of crabs to which the blue crab belongs is being conducted.

Bookhout, C. G.; Costlow, J. D.; and Monroe, R. 1980. Kepone\* effects on larval development of mud-crab and blue crab. *Water Air Soil Pollut.* 13:57-77.

Bookhout, C. G.; Monroe, R. J.; Forward, R. B., Jr.; and Costlow, J. D., Jr. 1984. Effects of soluble fractions of drilling fluids on development of crabs, *Rhithropanopeus harrisi* and *Callinectes sapidus*. *Water Air Soil Pollut.* 21:183-197.

Bookhout, C. G.; Monroe, R. J.; Forward, R. B., Jr.; and Costlow, J. D., Jr. 1984. Effects of hexavalent chromium on development of crabs, *Rhithropanopeus harrisi* and *Callinectes sapidus*. *Water Air Soil Pollut.* 21:199-216.

**Dr. Marius Brouwer.** Role of Metal Ions in Biological Systems.

(1) Basic studies on the mechanism of oxygen binding by respiratory metallo-proteins and by organo-metallic complexes. (2) Biochemical mechanisms of trace metal toxicity. (3) Characterization of structure and function of trace metal-binding proteins in marine crustacea.

Brouwer, M., and Brouwer-Hoexum, T. 1985. Mechanism of Cu(II) and Hg(II) induced loss of red blood cell deformability. *Fed. Proc.* 44:2620.

Brouwer, M.; Whaling, P.; and Engel, D. 1986. Copper-metallothioneins in the American lobster, *Homarus americanus*: Potential role as Cu(I) donors to apohemocyanin. *Environ. Health Perspect.* 65:93-100.

Engel, D. W., and Brouwer, M. 1987. Metal regulation and molting in decapod crustaceans: Metallothionein function in metal metabolism. *Biol. Bull.* 173:239-251.

**Dr. Robert Cashion.** Effect of Metabolic Intermediates on Hemoglobin Function.

Being investigated are the effects of metabolites on the oxygen binding properties of normal and abnormal human hemoglobins and on fish hemoglobins.

Cashion, R. 1981. The Malate Dehydrogenase Isozymes and Allozymes of *Fundulus heteroclitus*. The Johns Hopkins University Ph.D. dissertation.

Focesi, A.; Cashion, R.; Bonaventura, C.; and Bonaventura, J. 1983. Allosteric interactions of nicotinamide nucleotides and EDTA with human hemoglobin. *Fed. Proc.* 42:2030.

**Dr. Anthony S. Clare.** Invertebrate Endocrinology.

(1) Endocrine control of reproduction—spawning and vitellogenesis. (2) Functions of invertebrate eicosanoids. (3) Bioassay development for invertebrate hormones. (4) Effect of pesticides on regeneration of chelae in mud crabs and the role of hormones in this process.

Clare, A. S. 1987. Endocrinology of cirripedes. In *Barnacle Biology*, ed. A. J. Southward. Rotterdam: A. A. Balkema.

Clare, A. S.; van Elk, R.; and Feyen, J. H. M. 1986. Eicosanoids: Their biosynthesis in accessory sex organs of *Lymnaea stagnalis* (L.). *Int. J. Invertebr. Dev.* 10:125-131.

Clare, A. S.; Walker, G.; Holland, D. L.; and Crisp, D. J. 1985. The hatching substance of the barnacle, *Balanus balanoides* (L.). *Proc. R. Soc. Lond.* 224(B):131-147.

**Dr. John D. Costlow.** Crustacean Development.

Much of the research in developmental biology deals with the culture of invertebrate larvae under controlled conditions in the laboratory, from hatching until the juvenile stages are reached. The availability of numerous larvae of known species, age, and stage of development has led to studies on the extent to which environmental factors within the marine environment affect rates of development, survival, and morphological

normalities. In addition to studying the effects of natural environmental factors, research is under way to determine the effects of pollutants on larval development of marine crustacea. The developmental biology program also includes studies on the physiology of crustacean larvae and the factors involved in regulation of molting, rate of development, and metamorphosis during larval development.

A second major area of research interest involves the hormonal and physiological factors regulating barnacle development, settling, and metamorphosis. Present studies include the identification of naturally occurring substances in other marine organisms which inhibit or prevent the settlement of acorn barnacles and the mechanisms of detection by the larvae of these compounds.

West, T. L., and Costlow, J. D. 1987. Size regulation in larvae of the crustacean *Balanus eburneus* (Cirripedia: Thoracica). *Mar. Biol.* 96:47-58.

Wilson, J. E. H., and Costlow, J. D. 1987. Acute toxicity of diflubenzuron (DFB) to various life stages of the grass shrimp, *Palaemonetes pugio*. *Water Air Soil Pollut.* 33:411-417.

Costlow, J. D., and Tipper, R. C., eds. 1984. Marine biodeterioration: An interdisciplinary study. In *Proceedings of the Symposium on Marine Biodeterioration*, Uniformed Services, University of Health Sciences, 20-23 April 1981, 408 pp. Copyright 1984 U.S. Naval Institute Press, Annapolis, Maryland.

#### **Dr. Richard B. Forward, Jr.** Physiological Ecology.

This laboratory investigates the behavior and physiology of estuarine and coastal zooplankton. This includes the photobehavior, photophysiology, biological rhythms, diurnal vertical migration, and horizontal migration of crustacean larvae. Past students have worked with crustaceans and chaetognaths on the effects of temperature, salinity, and feeding on phototaxis and geotaxis, salinity perception, polarized light perception, and field studies of horizontal and vertical distributions as related to environmental factors.

Additional studies involve rhythms in egg hatching by crustaceans. Types of rhythms, flexibility, and the involvement of peptide pheromones are being considered.

Forward, R. B., Jr. 1987. A comparative study of crustacean larval photoresponse. *Mar. Biol.* 94:589-595.

Forward, R. B., Jr. 1987. Larval release rhythms of decapod crustaceans: An overview. *Bull. Mar. Sci.* 41:165-176.

Forward, R. B., Jr.; Cronin, T. W.; and Douglass, J. K. 1988. The visual pigments of crabs. II. Environmental adaptations. *J. Comp. Physiol.* 162:479-490.

#### **Dr. Donald J. Gerhart.** Chemical Ecology .

Many important ecological interactions, in both aquatic and terrestrial environments, are chemically mediated or influenced. Interests center on the biochemical ecology and evolution of marine invertebrates, especially chemical defenses, chemical systematics, and roles of secondary metabolites in invertebrate predator-prey symbioses, and the biochemical induction and inhibition of larval settlement. In collaboration with Dr. Daniel Rittschof and Dr. Richard Forward of Duke University and Dr. Bruce Erickson of the University of North Carolina, the potential involvement of peptides in pheromone communication systems of aquatic crustaceans is also being investigated.

Gerhart, D. J. 1983. Chemical systematics of colonial marine animals: An estimated phylogeny of the order Gorgonacea based on terpenoid characters. *Biol. Bull.* 164:71-81.

Gerhart, D. J. 1984. Prostaglandin A<sub>2</sub>: An agent of chemical defense in the gorgonian *Plexaura homomalla*. *Mar. Ecol. Progr. Ser.* 19:181-187.

Gerhart, D. J. 1986. Gregariousness in the gorgonian-eating gastropod *Cyphoma gibbosum*: Tests of several possible causes. *Mar. Ecol. Progr. Ser.* 31:255-263.

Gerhart, D. J.; Rittschof, D.; and Mayo, S. W. 1988. Chemical ecology and the search for marine antifoulants: Studies of a predator-prey symbiosis. *J. Chem. Ecol.* (In press.)

**Dr. John Gutknecht.** Membrane Physiology.

This laboratory studies the mechanisms of solute and water transport through phospholipid bilayer membranes which are used as models of biological membranes. Some of the specific questions sought include the following: (1) How do heavy metals, e.g., Hg and Cd, permeate biological membranes? (2) What are the mechanisms of action of salicylates, thiocyanate and other drugs on the gastric mucosa? (3) What are the mechanisms of proton and hydroxyl ion transport through lipid bilayer membranes? (4) What are the rate limiting steps in water and weak acid/base transport through membranes?

Gutknecht, J. 1981. Inorganic mercury transport through lipid bilayer membranes. *J. Membr. Biol.* 61:61-66.

Gutknecht, J. 1987. Proton/hydroxide conductance and permeability through phospholipid bilayer membranes. *Proc. Natl. Acad. Sci. USA* 84:6443-6446.

Gutknecht, J., and Walter, A. 1982. SCN<sup>-</sup> and HSCN<sup>-</sup> transport through lipid bilayer membranes: A model for SCN<sup>-</sup>-inhibition of gastric acid secretion. *Biochem. Biophys. Acta* 685:233-240.

**Dr. Paul J. Hearty.** Quaternary Coastal Dynamics.

Topics of current and proposed research include the following: geochronology and stratigraphy of coastal marine and lacustrine deposits, sea level history, Quaternary tectonic displacement of shorelines, and archeometry of early man lithic assemblages. The research concept is global in scope and includes sites from the circum-Mediterranean, Bermuda, the southeast U.S. Coastal Plain and the Carribean, the South Pacific and the rift-valley lakes of East Africa.

Hearty, P. J., and Aharon, P. 1988. Amino acid chronostratigraphy of late Quaternary coral reefs: Huon Peninsula, New Guinea and the Great Barrier Reef, Australia. *Geology* 16(7):579-583.

Hearty, P. J.; Miller, G. H.; Stearns, C. E.; and Szabo, B. J. 1986. Aminostratigraphy of Quaternary shorelines in the Mediterranean basin. *Geol. Soc. Am. Bull.* 97:850-858.

Vacher, H. L., and Hearty, P. J. 1988. History of stage-5 sea level in Bermuda: Review with new evidence of a brief rise to present sea level during substage 5a. *Quat. Sci. Rev.* (In press.)

**Dr. Thomas C. Johnson.** Geological Oceanography.

Research involves deep-sea sedimentation studies in the western North Atlantic and the application of oceanographic techniques to the study of sedimentation in large lakes. Present emphasis is upon Pleistocene paleocurrent studies in the Atlantic and high-resolution seismic reflection profiling, side-scan SONAR, and sediment core analyses in Lakes Turkana and Malawi, East Africa.

Johnson, T. C., and Davis, T. W. 1988. High resolution seismic profiles from Lake Malawi, East Africa. *J. African Earth Sci.* (in press.)

Johnson, T. C.; Halfman, J. D.; Rosendahl, B. R.; and Leister, G. S. 1987. Climatic and tectonic effects on sedimentation in a rift-valley lake: Evidence from high-resolution profiles, Lake Turkana, Kenya. *Geol. Soc. Amer. Bull.* 98:439-447.

Johnson, T. C.; Lynch, E. L.; and Showers, W. J. 1988. Pleistocene fluctuations in the western boundary undercurrent on the Blake Outer Ridge. *Paleoceanogr.* (In press.)

**Dr. Bruce E. Kenney.** Algal Ecological Physiology.

Physiological ecology of photosynthesis by marine algae, specifically the influence of environmental conditions on photosynthetic production, is my primary area of interest. Understanding time scales of environmental variability is essential to determining the influence of such variations on photosynthetic performance.

Evaluation of fixed carbon partitioning under varying environmental conditions is a current goal. Biotechnological funding supports ongoing research on properties and



production rate optimization of viscous polysaccharides from marine microalgae. Computer-aided data acquisition devices are being developed for rapid laboratory and field evaluation of several aspects of primary production, including short-term evaluation of the metabolic activity of the integrated water column ecosystem.

Kenney, B. E., and Ramus, J. 1983. Short-term variations in seaweed photosynthetic quotients. (*Abstr.* 21F-10, ASLO winter meeting.) *EOS* 64(52):1042.

Kenney, B. E.; Litaker, W.; Duke, C. S.; and Ramus, J. 1988. Community metabolism in a shallow tidal estuary. *Estuarine Coastal Shelf Sci.* (In press.)

Litaker, W.; Duke, C. S.; Kenney, B.; and Ramus, J. 1987. Short-term environment variability and phytoplankton abundance in a shallow tidal estuary. I. Winter and summer. *Mar. Biol.* 96:115-121.

**Dr. William W. Kirby-Smith.** Marine Ecology.

Funded research projects include: (1) a study of the fates and effects of pesticides and herbicide in estuaries; (2) the response of invertebrates, fish and birds to open marsh water management for mosquito control; and (3) aerial photographic mapping of the North Carolina estuarine sanctuaries. In addition, I work on problems associated with feeding and growth of suspension feeders in relation to quantity and quality of food.

Kirby-Smith, W. W., and Ustach, J. 1986. Resistance to hurricane damage of an epifaunal community on the continental shelf off North Carolina. *Estuarine Coastal Shelf Sci.* 23:433-442.

Takacs, R. L.; Forward, R. B., Jr.; and Kirby-Smith, W. 1988. Effects of the herbicide alachlor on larval development of the mud crab *Rhithropanopeus harrisi*. *Estuaries* (In press.)

**Dr. David R. McClay.** Cell-Cell Interaction in the Sea Urchin Embryo.

A number of molecules have been found that participate in the morphogenetic cell rearrangements during early development of the sea urchin embryo. The research efforts of this lab are to characterize the molecules involved, to determine their function, and to examine how the different steps of morphogenesis are interrelated in expression of pattern. The tools of the lab incorporate monoclonal antibody technology, biochemistry, immunochemistry, and molecular biology.

McClay, D. R., and Etensohn, C. A. 1987. Cell adhesion in morphogenesis. *Ann. Rev. Cell Biol.* 3:319-345.

Alliegro, M. C., and McClay, D. R. 1988. Storage and mobilization of extracellular matrix proteins during sea urchin development. *Dev. Biol.* 125:208-216.

Etensohn, C. A., and McClay, D. R. 1988. Cell lineage conversion in the sea urchin embryo. *Dev. Biol.* 125:396-409.

**Dr. Barry Osmond.** Plant Physiological Ecology.

The physiology and ecology of photosynthesis in marine organisms shows many analogies, as well as differences, with the same processes in land plants. Collaboration with Dr. J. Ramus is designed to explore the processes of light acclimation and potential susceptibility to photoinhibition in marine macroalgae under different light and temperature conditions during growth. Other studies of natural abundance stable isotope composition can be used to explore biochemical (enzymatic) and physical (diffusional) limitations to photosynthetic CO<sub>2</sub> uptake in seawater.

Anderson, J. M., and Osmond, C. B. 1987. Sun-shade responses compromises between acclimation and photoinhibition. In *Photoinhibition*, Topics in Photosynthesis, eds. D. J. Kyle, C. B. Osmond and C. J. Arntzen, vol. 9, pp. 1-38. Amsterdam: Elsevier.

Chow, W. S.; Osmond, C. B.; and Huang, L.-K. 1988. Photosystem II function and herbicide binding sites during photoinhibition of spinach chloroplasts *in-vivo* and *in-vitro*. *Photosynthetic Res.* (In press.)

Ehleringer, J. R., and Osmond, C. B. 1988. Stable isotopes. In *Plant Physiological Ecology: Field Methods and Instrumentation*, eds. R. W. Pearcy, H. A. Mooney and J. R. Ehleringer. Chapman and Hall. (In press.)

**Dr. J. Ramus.** Algal Ecological Physiology.

We study physical forcing of primary productivity in a coastal plains estuary characterized by high flushing rates and variable nutrient inputs. To do so requires time-intensive sampling on the estuary—including selected hydrology, water chemistry, meteorology, and productivity parameters. Ultimately, the research seeks a match between species specific physiological response and the temporal frequency of nutrient availability, the phasing of the organism with its environment.

Biotechnological research includes extracellular polysaccharides produced by marine microphotoautotrophs. Two aspects are under investigation: (1) environmental regulation of carbon partitioning, i.e., the diversion of newly fixed carbon from growth (new photosynthetic machinery) to disposable heteropolysaccharides (viscoelastic biopolymers), and (2) drag reducing properties of the biopolymers in pipe flow.

A third area of investigation is photoacclimation in seaweeds. Of specific interest are macromolecular changes in the photosynthetic apparatus, the dynamic range of change and the effect of change on growth rate.

Ramus, J., and Venable, M. 1987. Temporal ammonium patchiness and growth rate in *Codium* and *Ulva* (Ulvophyceae). *J. Phycol.* 23:518-523.

Duke, C. S.; Lapointe, B. E., and Ramus, J. 1986. Effect of light on growth, RuBP-Case activity and chemical composition of *Ulva* species (Chlorophyta). *J. Phycol.* 22:362-370.

Litaker, W.; Duke, C. S.; Kenney, B. E.; and Ramus, J. 1987. Short-term environmental variability and phytoplankton abundance in a shallow tidal estuary. I. Winter and summer. *Mar. Biol.* 96:115-121.

**Dr. Daniel Rittschof.** Chemical Ecology.

(1) Basic studies of the chemical nature and functions of pheromones and other substances used in resource location. (2) Contact chemoreception, chemical induction and inhibition of larval settlement. (3) Isolation and purification of native bioactive molecules. (4) Chemical ecology of terrestrial crabs.

Rittschof, D., and Gruber, G. 1988. Response to prey odors by oyster drills, *Urosalpinx cinerea cinerea*, *Urosalpinx cinerea follyensis*, and *Eupleura caudata etteme*. *Mar. Behav. Physiol.* (In press.)

Maki, J.; Rittschof, D.; Mitchell, R.; and Costlow, J. D. 1988. Effects of bacterial films on settlement of barnacle larva. *Mar. Biol.* 97:199-206.

Forward, R. B., Jr.; Rittschof, D.; and DeVries, M. 1987. Peptide pheromones synchronize crustacean egg hatching and larval release. *Chem. Sens.* 12(3):491-498.

**Drs. J. David Robertson and John Z. Young.** Learning and Memory.

This laboratory is investigating the cellular basis of learning and memory using *Octopus vulgaris* as the experimental animal. The work is now concentrated on tactile learning and memory. Previous work has shown that octopus is a very favorable animal for this research because tactile learning and memory is localized in the posterior buccal and subfrontal lobes of the supraesophageal lobe of its brain. Surgical removal of these parts of the brain completely abolish tactile learning and memory. The drug Cytochalasin B, which has the peculiar property of causing disruption of actin dependent portions of the cytoskeleton of cells, has been found to be as effective as surgical excision in blocking tactile learning and memory in this animal. The animal is being studied behaviorally and the relevant parts of the brain are being studied structurally and biochemically using electron microscopy and various biochemical and immunological methods.

Robertson, J. D.; Young, J. Z.; Lee, P.; and Bock, C. 1987. Tactile learning in octopus is affected by Cytochalasin B. *Soc. Neurosci. Abstr.* 13(2):803.

Robertson, J. D.; Young, J. Z.; Lee, P. H.; Bock, C. B. 1987. Possible effects of Cytochalasin on memory in octopus. In *2nd World Conference of Neuroscience Abstr.* (Budapest, August 16-21, 1987.) (In press.)

Allen, A.; Michels, J.; and Young, J. Z. 1985. Memory and visual discrimination in squids. *Mar. Behav. Physiol.* 11:271-282.

Allen, A.; Michels, J.; and Young, J. Z. 1986. Possible interactions between visual and tactile memories in octopus. *Mar. Behav. Physiol.* 12:81-97.

**Dr. Richard B. Searles.** Seaweed Systematics.

Biology of seaweeds with emphasis on systematics, ecology, and biogeography of tropical algae from North Carolina and the Caribbean.

Searles, R. B. 1984. Seaweed biogeography of the mid-Atlantic coast of the United States. *Helgolander Meeresunter.* 38:259-271.

Searles, R. B., and Ballantine, D. L. 1986. *Dudresnaya puertoricensis* sp. nov. (Dumontiaceae, Gigartinales, Rhodophyta). *J. Phycol.* 22:389-394.

Searles, R. B., and Schneider, C. W. 1987. Observations on the deep-water flora of Bermuda. *Hydrobiologia* 151/152:261-266.

**Dr. J. Bolling Sullivan.** Comparative Protein Biochemistry.

The primary emphasis in the biochemical studies involves research on the structure, function, and evolution of protein molecules. Proteins, especially those involved in the transport of molecular oxygen (hemoglobin, hemocyanin, chlorocruorin, and hemerythrin), are being isolated and their structural and functional properties elucidated. These studies are intended to illustrate how protein molecules function, as well as how they have evolved. Studies of protein polymorphisms are intended to illustrate gene flow among populations and offer insights into the adaptive strategies of marine organisms.

Sullivan, B.; Pennell, L.; Hutchison, B.; and Hutchings, R. 1983. Genetics and evolution of the hemocyanin multigene. I. Genetic variability in *Uca pugilator* from Beaufort, N.C. *Comp. Biochem. Physiol.* 76:615-618.

Sullivan, B.; Miller, K.; Singleton, K.; Scheer, A. G.; and Williams, A. B. 1984. Electrophoretic analyses of hemocyanins from four species of mud crabs, genus *Panopeus*, with observations on the ecology of *P. obesus*. *Fish. Bull.* (In press.)

**Dr. John Sutherland.** Marine Ecology.

The research attempts to identify and understand the processes which result in the temporal and spatial patterns in species abundance in intertidal and subtidal, epibenthic communities. Changes in the adult populations are followed with point sampling and photographic techniques. The approach is experimental to the extent that species are removed or excluded from the community to assess their importance in community structure and function. This work was initiated with estuarine animal populations near Beaufort. Comparable work is now being done on the plant and animal populations in the rocky substrates of southern Chile and the Pacific coast of Central America.

Sutherland, J. P. 1981. The fouling community at Beaufort, North Carolina: A study in stability. *Am. Nat.* 118:499-519.

Sutherland, J. P. 1987. Recruitment limitation in a tropical intertidal barnacle: *Tetraclita panamensis* (Pilsbry) on the Pacific coast of Costa Rica. *J. Exp. Mar. Biol. Ecol.* 113:267-282.

Sutherland, J. P., and Ortega, S. 1985. Competition conditional on recruitment and temporary escape from predators on a tropical rocky shore. *J. Exp. Mar. Bio. Ecol.* 95:155-166.

**Dr. Joseph Ustach.** Marsh Ecology.

Structure and functioning of wetlands, especially salt marshes, within the estuarine system. Major areas of interest are: primary production; decomposition; detritus formation and utilization; habitat utilization; microbial-meiofaunal interactions.



Ustach, J. F. 1982. Algae, bacteria and detritus as foods for the harpacticoid copepod, *Heteropsyllus pseudonunni* Coull and Palmer. *J. Exp. Mar. Biol. Ecol.* 64:203-214.

Heinle, D. R.; Flemer, D. A.; and Ustach, J. F. 1976. Contribution of tidal marshlands to mid-Atlantic estuarine food chains. In *Estuarine Processes*, ed. M. Wiley, pp. 309-320. New York: Academic Press.

**Dr. Stephen A. Wainwright.** Functional Morphology and Biomechanics.

Plants and animals have specialized structural materials, skeletal elements, and entire supportive systems that permit, control, and limit their posture, movement, and behavior in response to forces of gravity, flow, pressure, and muscle contraction. At Duke University Marine Laboratory we are studying the mechanical design of (1) swimming in sharks, rays, marlin, and king mackerel, (2) bending and pulling (to open oysters) by starfish, (3) movement and holding position on surf-beaten beaches by the coquina clam, and (4) stabilization of sediment by blue-green bacterial mats.

Wainwright, S. A. 1983. To bend a fish. In *Fish Biomechanics*, eds. P. W. Webb and D. Wiehs, pp. 68-91. New York: Praeger.

Koehl, M. A. R., and Wainwright, S. A. 1977. Mechanical adaptations of a giant kelp. *Limnol. Oceanogr.* 22:1067-1071.

Hebrank, M. R., and Hebrank, J. H. 1986. The mechanics of fish skin: Lack of an "external tendon" role in two teleosts. *Biol. Bull.* 171:236-247.

## Research Facilities

Visiting investigators may obtain research space throughout the year. Each research laboratory building is air-conditioned and equipped with running seawater through a PVC system. There are tanks, water tables, aquaria, autoclaves, ovens, and outdoor continuous-flow growth facilities. In addition to commonly used laboratory equipment, the following are available: refrigerated centrifuges, fluorometers, spectrophotometers, balances, pH meters, hoods, liquid scintillation counter, constant temperature equipment, and HPLC. There is a complete sedimentological research laboratory that is equipped for state-of-the-art chemical and size analyses. The Marine Laboratory also maintains darkrooms, a well-equipped workshop, a stock room, and a purchasing department.

As a result of funds provided by the National Science Foundation, the following new research equipment and systems are available to visiting investigators at Duke Marine Laboratory as well as to resident research personnel: water purification system, spectrophotometer, camera, recorder and accessories, spectrofluorometers, power supply, M-Drive, CRT screens, and a printer for the Compupro computer, a respirometer as well as accessory items for the existing underwater spectroradiometer. The most recently funded acquisitions include a motion analyses system, static image analyzer, and draft plotter.

In addition, the National Science Foundation has funded a number of general facility improvements such as renovations to the R/V *First Mate*, renovations to the seawater system, and updating the autoanalyzer to state-of-the-art equipment.

Funding made available by the Office of Naval Research has provided for a flow injection nutrient analyzer, IBM AT computer, and accessory items for the existing underwater spectroradiometer.

**I. E. Gray Library-Auditorium.** Located in the building are the 1,917 square feet auditorium, with stage, a library, the librarian's office, two seminar rooms, a receiving room, a kitchenette, and two closed carrels. The auditorium has a seating capacity of approximately 300 and is suitable for lectures, seminars, symposia, and small regional or national meetings. Inquiries concerning use of auditorium or seminar room space should be addressed to Personnel and Auxiliaries, Duke University Marine Laboratory, Beaufort, North Carolina 28516.

The building houses the Pearse Memorial Library which contains about 53,000 catalogued reference books and journals, 135 current journals, and 23,000 reprints. There are also expedition reports in oceanography, a microfilm library of graduate student theses based on research at the laboratory, and a microfilm reader. Other materials may be obtained by special delivery system from the Perkins Library on the Durham campus or through the interlibrary loan service with other libraries in the United States.

**Natural History Resource Center.** The Natural History Resource Center (NHRC) preserves and disseminates knowledge concerning ecological systems and the distribution and abundance of marine plants and animals. The center consists of an extensive reference collection of marine organisms (the museum), a library of taxonomic references and ecological publications, and a research laboratory designed to facilitate the collection, preservation and identification of marine organisms. The center provides students, researchers, and laymen with advice on the natural history of North Carolina's marine ecosystems. With its growth in size and function, the NHRC plans to expand its service through the publication of a technical reports and monographs series. Dr. William W. Kirby-Smith is director of the Natural History Resource Center.

**Computing Facilities.** The Marine Laboratory operates a Compupro System 8/16 computer for use by staff, students, and visiting investigators. The computer has 1 MB of memory and is operated under the MC-DOS operating system. The BASIC, FORTRAN, and Pascal programming languages are available, as well as application programs for word processing, statistical analysis, data base management, and graphics. A 21Mb hard disk drive and two eight-inch floppy disk drives are used for data storage. There are a variety of video terminals, graphics terminals, printers and plotters.

The Marine Laboratory is also the site of one of Duke University's public IBM clusters. Three work stations are networked to an IBM/AT which has a 30Mb hard disk drive. The BASIC language is available along with programs for word processing and data base management. Statistical analysis is by means of a PC/SAS, installed on the hard disk drive. Each station is an IBM/XT with two 5.25 inch floppy disks, 640K memory, and math coprocessor. Output is by means of two IBM Proprinters.

**R/V Cape Hatteras.** The Duke/University of North Carolina Oceanographic Consortium operates a 135-foot research vessel, the R/V *Cape Hatteras*. The ship operates both on the continental shelf and in the deep sea in the western North Atlantic, concentrating in the region between Nova Scotia on the north, the Caribbean on the south, and Bermuda to the east. The ship is a member of the academic research fleet supported by the National Science Foundation for the purpose of providing oceanographic research opportunities to investigators. Inquiries concerning use of the research vessel should be addressed to the Duke/UNC Oceanographic Consortium, Marine Laboratory, Duke University, Beaufort, North Carolina 28516.

## Financial Information

*Figures quoted in this section are projections and may be subject to change in many cases without prior notice. All rates are effective 9 May 1988 to 14 May 1989.*

**Room and Board Costs.** All Duke University Marine Laboratory visitors who stay on the island will pay a room and board fee as follows: \$23 per day (1-6 days); \$144 per week (7 + days). Allowances will be made only for meals missed at the beginning and end of the stay.

**Boat Rentals.** The following boats are available at the laboratory for collecting and instructional activities. Charges apply to all research and teaching activities.

Boat Type	Charges
50 ft. cruiser/trawler ( <i>First Mate</i> )*	\$40 per hour
20 ft. outboard runabouts	\$20 per hour
16 ft. outboard runabout	\$15 per hour
Outboard skiffs	\$ 5 per hour

\*Crew required for safety of user and vessel.

NOTE: Overtime, if applicable, is \$40 per hour for the *First Mate*; \$20 per hour for other craft.

These rates are intended to partially defray the cost of operating and maintaining these boats.

These boats may be scheduled by visiting researchers through the Maintenance Office; however, first priority must be given to classes when they are in session. Use of Duke University Marine Laboratory vessels for any sponsored research will be subject to charges.

**Research Space.** Research space, including seawater tables, is available on a limited basis for Duke University Marine Laboratory visitors. Research space rent for all users is \$2.25 per square foot per month. Typical size of laboratory-office area is 100 square feet. Requests for laboratory space, office space, and/or seawater tables should be sent to Personnel and Auxiliaries, Duke University Marine Laboratory, Beaufort, North Carolina 28516.

**Teaching Space.** Various size classrooms are available throughout the year; however, first priority must be given to Marine Laboratory classes when they are in session. Cost for such space is \$25-\$35/day depending upon which laboratory is utilized. Requests for these teaching areas, including class needs such as seawater tables, collecting equipment, etc., should be sent to Personnel and Auxiliaries, Duke University Marine Laboratory, Beaufort, North Carolina 28516.



APPLICATION FOR ENROLLMENT IN THE DUKE UNIVERSITY MARINE LABORATORY  
UNDERGRADUATE MARINE SCIENCES PROGRAM

Please fill out completely; type or print.

Please specify: Spring Semester \_\_\_\_\_  
Year

Date \_\_\_\_\_

Fall Semester \_\_\_\_\_  
Year

1. Mr., Ms. \_\_\_\_\_  
Last First Middle

2. Social Security Number \_\_\_\_\_

3. Date of Birth: Month \_\_\_\_\_ Day \_\_\_\_\_ Year \_\_\_\_\_

4. A. Current full mailing address:

Street or P.O. Box \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Telephone Number (including area code) \_\_\_\_\_

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Telephone Number (including area code) \_\_\_\_\_

5. Name and full mailing address of parents or guardian:

Name \_\_\_\_\_ Relationship \_\_\_\_\_

Street or P.O. Box \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Telephone Number (including area code) \_\_\_\_\_

6. **DUKE STUDENT** (only)

A. Trinity \_\_\_\_\_ Engineering \_\_\_\_\_ Other (specify) \_\_\_\_\_

B. Major \_\_\_\_\_

C. Class (e.g., junior, senior) at time of enrollment at DUML \_\_\_\_\_

D. Expected date of graduation \_\_\_\_\_

NOTE: Duke Students must obtain the approval of their assigned departmental adviser on this application.

E. Adviser's signature \_\_\_\_\_ Date \_\_\_\_\_

7. **NONDUKE STUDENT** (Students from institutions other than Duke who are attending for the semester only and who will be classified as special, nondegree students)

A. Name and address of home institution:

\_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

B. Major \_\_\_\_\_

C. Class (e.g., junior, senior) at time of enrollment at DUML \_\_\_\_\_

D. Expected date of graduation \_\_\_\_\_

E. The following person has been requested to mail a letter of recommendation to the Admissions Office of the Duke University Marine Laboratory:

Name \_\_\_\_\_ Position \_\_\_\_\_

Institution \_\_\_\_\_

F. Transcript(s) will be sent by the following institution(s):

\_\_\_\_\_  
\_\_\_\_\_

G. List courses currently in progress (which would not yet appear on a transcript):

\_\_\_\_\_  
\_\_\_\_\_

H. Have you ever been placed on probation or suspended or dismissed from any school?

No \_\_\_\_\_ Yes \_\_\_\_\_ (If yes, please explain below.)

**Mail Application to:**

**Admissions  
Duke University Marine Laboratory  
Beaufort, North Carolina 28516**

APPLICATION FOR ENROLLMENT IN THE DUKE UNIVERSITY MARINE LABORATORY  
SUMMER SESSION

Fill out completely; type or print.

Date \_\_\_\_\_

Mr. Ms. \_\_\_\_\_  
Last First Middle

Date of Birth: Month \_\_\_\_\_ Day \_\_\_\_\_ Year \_\_\_\_\_

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City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Telephone Number (including area code) \_\_\_\_\_

**DUKE STUDENT**

Undergraduate: Trinity \_\_\_\_\_ Engineering \_\_\_\_\_ Other (please specify) \_\_\_\_\_

Graduate: Grad. Sch. Arts & Sci. \_\_\_\_\_ Sch. Forestry & Env. Studies \_\_\_\_\_

Other (please specify) \_\_\_\_\_

Class (e.g., junior, 1st yr. M.S.) at time of enrollment at DUML \_\_\_\_\_

Expected date of graduation \_\_\_\_\_

Major \_\_\_\_\_

**NONDUKE STUDENT (Attending Summer Session only)**

Unclassified: Prebaccalaureate \_\_\_\_\_ Class (e.g., junior) \_\_\_\_\_

Postbaccalaureate \_\_\_\_\_ Class (e.g., 1st yr. M.S.) \_\_\_\_\_

Major \_\_\_\_\_

Expected date of graduation \_\_\_\_\_

If presently attending, list name and address of school: \_\_\_\_\_  
\_\_\_\_\_

Have you previously attended Duke: No \_\_\_\_\_ Yes \_\_\_\_\_ (Give dates): \_\_\_\_\_

Have you received a degree from Duke: No \_\_\_\_\_ Yes \_\_\_\_\_ (Give dates): \_\_\_\_\_



ALL STUDENTS (Applying to courses numbered 100 or higher)

List courses currently in progress (which would not yet appear on a transcript):

\_\_\_\_\_  
\_\_\_\_\_

List other colleges and/or universities attended and degree(s) received: \_\_\_\_\_

EACH APPLICANT IS REQUIRED TO COMPLETE AND SUBMIT THIS APPLICATION BLANK AND TRANSCRIPT(S) (transcript required of students applying to courses numbered 100 or higher) OF ACADEMIC WORK COMPLETED TO DATE TO THE ADMISSIONS OFFICE. NOTE: A maximum of one 6 graduate unit or 1½ course program (6 semester hours) will be permitted per term (unless appropriate approval is obtained); FIRST AND SECOND CHOICES SHOULD BE INDICATED. LIST COURSE(S) DESIRED BELOW:

**FIRST TERM:**

Course Number	Course Title
1. _____	_____
2. _____	_____

(DUKE STUDENTS ONLY) Approval of assigned adviser; after May 9, Dean's approval required.

Adviser's/Dean's Signature \_\_\_\_\_ Date \_\_\_\_\_

**SECOND TERM:**

Course Number	Course Title
1. _____	_____
2. _____	_____

(DUKE STUDENTS ONLY) Approval of assigned adviser; after May 9, Dean's approval required.

Adviser's/Dean's Signature \_\_\_\_\_ Date \_\_\_\_\_

**THIRD TERM:**

Course Number	Course Title
1. _____	_____
2. _____	_____

(DUKE STUDENTS ONLY) Approval of assigned adviser; after May 9, Dean's approval required.

Adviser's/Dean's Signature \_\_\_\_\_ Date \_\_\_\_\_

**SUMMER TUITION SCHOLARSHIPS AVAILABLE ON COMPETITIVE BASIS.** In addition to this completed application and current academic transcript(s), scholarship applicants must submit a letter of recommendation from academic faculty and a brief statement of purpose, i.e., the reason for taking the particular course. To be considered for a summer tuition scholarship an applicant must first be admitted to a specific course. All supporting scholarship credentials must be received by the Admissions Office of the Marine Laboratory no later than Thursday, March 30, 1989. For additional information, see the section on Financial Assistance in the 1989 Marine Laboratory Bulletin. Please complete below:

Please consider me for a summer tuition scholarship: YES \_\_\_\_\_ NO \_\_\_\_\_

Mail Application to:

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Beaufort, North Carolina 28516

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Telephone Number (including area code) \_\_\_\_\_

**DUKE STUDENT**

Undergraduate: Trinity \_\_\_\_\_ Engineering \_\_\_\_\_ Other (please specify) \_\_\_\_\_

Graduate: Grad. Sch. Arts & Sci. \_\_\_\_\_ Sch. Forestry & Env. Studies \_\_\_\_\_

Other (please specify) \_\_\_\_\_

Class (e.g., junior, 1st yr. M.S.) at time of enrollment at DUML \_\_\_\_\_

Expected date of graduation \_\_\_\_\_

Major \_\_\_\_\_

**NONDUKE STUDENT (Attending Summer Session only)**

Unclassified: Prebaccalaureate \_\_\_\_\_ Class (e.g., junior) \_\_\_\_\_

Postbaccalaureate \_\_\_\_\_ Class (e.g., 1st yr. M.S.) \_\_\_\_\_

Major \_\_\_\_\_

Expected date of graduation \_\_\_\_\_

If presently attending, list name and address of school: \_\_\_\_\_

Have you previously attended Duke: No \_\_\_\_\_ Yes \_\_\_\_\_ (Give dates): \_\_\_\_\_

Have you received a degree from Duke: No \_\_\_\_\_ Yes \_\_\_\_\_ (Give dates): \_\_\_\_\_

ALL STUDENTS (Applying to courses numbered 100 or higher)

List courses currently in progress (which would not yet appear on a transcript):

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List other colleges and/or universities attended and degree(s) received: \_\_\_\_\_

EACH APPLICANT IS REQUIRED TO COMPLETE AND SUBMIT THIS APPLICATION BLANK AND TRANSCRIPT(S) (transcript required of students applying to courses numbered 100 or higher) OF ACADEMIC WORK COMPLETED TO DATE TO THE ADMISSIONS OFFICE. NOTE: A maximum of one 6 graduate unit or 1½ course program (6 semester hours) will be permitted per term (unless appropriate approval is obtained); FIRST AND SECOND CHOICES SHOULD BE INDICATED. LIST COURSE(S) DESIRED BELOW:

**FIRST TERM:**

Course Number	Course Title
1. _____	_____
2. _____	_____

(DUKE STUDENTS ONLY) Approval of assigned adviser; after May 9, Dean's approval required.

Adviser's/Dean's Signature \_\_\_\_\_ Date \_\_\_\_\_

**SECOND TERM:**

Course Number	Course Title
1. _____	_____
2. _____	_____

(DUKE STUDENTS ONLY) Approval of assigned adviser; after May 9, Dean's approval required.

Adviser's/Dean's Signature \_\_\_\_\_ Date \_\_\_\_\_

**THIRD TERM:**

Course Number	Course Title
1. _____	_____
2. _____	_____

(DUKE STUDENTS ONLY) Approval of assigned adviser; after May 9, Dean's approval required.

Adviser's/Dean's Signature \_\_\_\_\_ Date \_\_\_\_\_

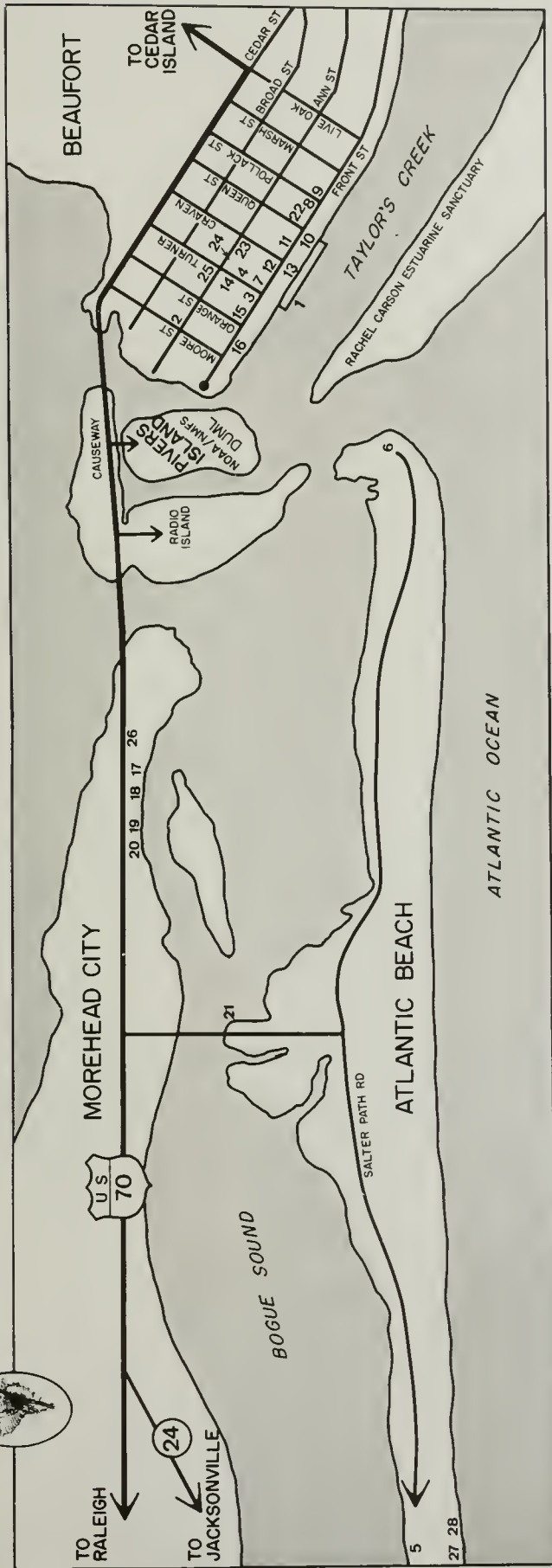
**SUMMER TUITION SCHOLARSHIPS AVAILABLE ON COMPETITIVE BASIS.** In addition to this completed application and current academic transcript(s), scholarship applicants must submit a letter of recommendation from academic faculty and a brief statement of purpose, i.e., the reason for taking the particular course. To be considered for a summer tuition scholarship an applicant must first be admitted to a specific course. **All supporting scholarship credentials must be received by the Admissions Office of the Marine Laboratory no later than Thursday, March 30, 1989.** For additional information, see the section on Financial Assistance in the 1989 Marine Laboratory Bulletin. **Please complete below:**

Please consider me for a summer tuition scholarship: YES \_\_\_\_\_ NO \_\_\_\_\_

Mail Application to:

Admissions  
Duke University Marine Laboratory  
Beaufort, North Carolina 28516

# DUKE UNIVERSITY MARINE LABORATORY AND ENVIRONS



POINTS OF INTEREST	RESTAURANTS	LODGING	MILEAGES FROM DUMUL TO:
1 BOARDWALK	10 BEAUFORT HOUSE	15 THE CEDARS	NEW BERN AIRPORT . . . . . 37.5
2 COSTLOW HOME (201 ANN ST)	11 MIKE'S	22 INLET INN	JACKSONVILLE AIRPORT . . . . . 60
3 N.C. MARITIME MUSEUM	12 CLAWSON'S	23 LANGDON HOUSE	KINSTON AIRPORT . . . . . 80
4 BEAUFORT RESTORATION	13 DOCK HOUSE	24 SHOTGUN HOUSE	WILMINGTON AIRPORT . . . . . 85
5 N.C. MARINE RESOURCES CENTER	14 NET HOUSE	25 CAPT.'S QUARTERS	RALEIGH/DURHAM AIRPORT . . . 160
6 FT. MACON STATE PARK	15 THE CEDARS	26 JEFFERSON	DURHAM . . . . . 180
7 FIRST CITIZENS BANK	16 SPOUTER INN	27 HOLIDAY INN	
8 BRANCH BANKING & TRUST	17 CHARTER	28 ATLANTIS	
9 U.S. POST OFFICE	18 SANITARY		
	19 CAPT. BILL'S		
	20 OTIS' FISH HOUSE		
	21 CHANNEL MARKER		













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Beaufort, NC 28516

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*bulletin of*  
**Duke University**  
**1989-90**

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*The Divinity School*







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*bulletin of*  
**Duke University**  
**1989-90**

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*The Divinity School*

EDITOR  
Judy Smith  
SENIOR EDITORIAL ASSISTANTS  
Elizabeth Matheson

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The information in the bulletin applies to the academic year 1989-90 and is accurate and current, to the best of our knowledge, as of February, 1989. The university reserves the right to change programs of study, academic requirements, lecturers, teaching staffs, the announced university calendar, and other matters described in the bulletin without prior notice, in accordance with established procedures.

Duke University does not discriminate on the basis of race, color, national and ethnic origin, handicaps, sexual orientation or preference, sex, or age in the administration of educational policies, admission policies, financial aid, employment, or any other university program or activity. It admits qualified students to all the rights, privileges, programs, and activities generally accorded or made available to students. For further information, call Dolores L. Burke, Equal Opportunity Officer, (919) 684-8111.

For further information about the Divinity School, call (919) 684-3234.



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# Calendar of the Divinity School

Fall, 1989

<b>August</b>	
23	Wednesday—Orientation for new students begins
24	Thursday—Orientation continues
25	Friday, 9:00-10:30 A.M.—Registration for returning students 10:30-12:00 noon—Registration for new students
28	Monday, 12:00 noon—Fall semester classes begin
28	Monday—Drop/add period begins
29	Tuesday, 10:00 A.M.—Divinity School Opening Convocation—Duke University Chapel
<b>September</b>	
8	Friday, 12:00 noon—Drop/add period ends
<b>October</b>	
13	Friday, 4:00 P.M.—Last day to withdraw with "W" 6:00 P.M.—Fall recess begins
18	Wednesday, 8:30 A.M.—Fall recess ends
25-26	Wednesday-Thursday—Registration for spring semester
30-31	Monday-Wednesday—Divinity School Convocation and Pastors' School, Gray Lectures and Hickman Lectures
<b>November</b>	
1	Divinity School Convocation and Pastors' School, Gray Lectures and Hickman Lectures
22	Wednesday, 1:00 P.M.—Thanksgiving recess begins
27	Monday, 12:00 Noon—Classes resume
<b>December</b>	
8	Friday—Fall semester classes end
12	Tuesday—Final examinations begin
15	Friday—Final examinations end

## Spring, 1990

<b>January</b>	
9	Tuesday—Orientation for new students
10	Wednesday—Registration for new students; registration changes for returning students
11	Thursday, 8:30 A.M.—Spring semester classes begin—Drop/add period begins
24	Wednesday, 12:00 Noon—Drop/add period ends
<b>March</b>	
9	Friday, 4:00 P.M.—Last date to withdraw with "W"; 6:00 P.M.—Spring recess begins
19	Monday, 12:00 Noon—Spring classes resume
28-29	Wednesday-Thursday—Registration for fall semester
<b>April</b>	
12	Maundy Thursday—Classes do not meet
13	Good Friday—Classes do not meet
25	Wednesday, 10:00 A.M.—Divinity School Closing Convocation—Duke University Chapel
27	Friday—Spring semester classes end
<b>May</b>	
1	Tuesday—Final examinations begin
4	Friday—Final examinations end
12	Saturday, 6:30 P.M.—Divinity School Baccalaureate Service
13	Sunday, 10:00 A.M.—Commencement exercises

# University Administration

## GENERAL ADMINISTRATION

H. Keith H. Brodie, M.D., LL.D., *President*  
Phillip A. Griffiths, Ph.D., *Provost*  
Ralph Snyderman, M.D., *Chancellor for Health Affairs and Dean of the Medical School*  
William G. Anlyan, M.D., D.Sc., *Chancellor*  
Eugene J. McDonald, LL.M., *Executive Vice-President*  
Joel L. Fleishman, LL.M., *Senior Vice-President*  
J. Peyton Fuller, A.B., *Vice-President, Planning and Treasurer*  
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John J. Piva, Jr., B.A., *Vice-President for Alumni Affairs and Development*  
Patricia C. Skarulis, M.A., *Vice-President for Information Systems*  
Andrew G. Wallace, M.D., *Vice-President for Health Affairs*  
John F. Adcock, M.B.A., *Vice-President and Corporate Controller*  
Tom A. Butters, B.A., *Vice-President and Director of Athletics*  
N. Allison Haltom, A.B., *Secretary of the University*

# Divinity School Administration

## EDUCATIONAL ADMINISTRATION

Dennis M. Campbell (1979), B.D., Ph.D., D.D., *Dean of the Divinity School*  
Russell E. Richey (1986), B.D., Ph.D., *Associate Dean for Academic Programs*  
B. Maurice Ritchie (1973), B.D., Th.M., *Associate Dean for Student Life and Field Education*  
Paula E. Gilbert (1980), M.Div., Ph.D., *Assistant Dean for Planning and Special Projects*  
Gregory F. Duncan (1988), M.Div., *Director of Admissions*  
Wesley F. Brown (1981), M.Div., *Director of Development and Alumni Affairs*  
W. Joseph Mann (1984), M.Div., S.T.M., *Director of Continuing Education*  
William C. Turner, Jr. (1989), M.Div., Ph.D., *Director of Black Church Affairs*  
Kelli Walker-Jones (1985), M.Div., *Associate Director of Admissions and Development*  
Carter S. Askren (1988), B.S., *Director of Communications*  
Clara S. Godwin (1969), *Administrative Assistant for General Administration and Finance*  
Wilson O. Weldon (1981), B.D., D.D., *Special Assistant to the Dean*

## Division of Special Programs

Robert L. Wilson (1970), B.D., Ph.D., *Director, J. M. Ormond Center for Research, Planning, and Development*

## Division of Advanced Studies

Stanley Hauerwas, Ph.D., *Director of Graduate Studies in Religion*

## Library

Donn Michael Farris (1950), M.Div., M.S. in L.S., *Librarian*  
Harriet V. Leonard (1960), M.Div., M.S. in L.S., *Reference Librarian*  
Tom Clark, B.A., *Circulation Librarian*  
Susan A. Rogers, M.Div., *Assistant Circulation Librarian*  
Melissa Harrell, B.S., *Assistant to the Librarian*

## SUPPORT STAFF

Virginia W. Ashmore, B.A., *Faculty Secretary*  
Margaret Lois Blanton, *Administrative Secretary, Office of the Dean*  
Anita Gail Chappell, *Faculty Secretary*  
Mary P. Chestnut, *Secretary, Office of Black Church Affairs and Faculty Secretary*  
Mary Deasey Collins, M.S., Ph.D., *Administrative Secretary, Registry*  
Anne Cordts, *Administrative Secretary, Office of Continuing Education*  
Sarah Freedman, M.A., *Faculty Secretary*  
Maxie B. Honeycutt, *Financial Aid Assistant*  
Marjorie L. Lobsiger, *Faculty Secretary*  
Margie M. Meeler, *Secretary, Office of Student Life and Field Education*  
Frances D. Parrish, *Staff Assistant*  
Virginia Parrish, *Faculty Secretary*  
Annie C. Ragan, *Faculty Secretary*



Marie Smith, *Secretary, Office of Development and Alumni Affairs, and Faculty Secretary*  
Betty Anne "Dink" Suddaby, *Secretary, Office of Admissions and Student Life*  
Shelby Carver Wallen, *Word Processing Coordinator and Faculty Secretary*

## FACULTY

- Lloyd Richard Bailey (1971), B.D., Ph.D., *Associate Professor of Old Testament*  
Teresa Berger (1985), L.Th., M.Th., Ph.D., *Assistant Professor of Ecumenical Theology*  
Dennis M. Campbell (1979), B.D., Ph.D., D.D., *Professor of Theology*  
Jerry D. Campbell (1985), M.Div., M.S. in L.S., Ph.D., *Professor of the Practice of Theological Bibliography*  
\* Ted A. Campbell (1985), Ph.D., *Assistant Professor of Church History*  
James L. Crenshaw (1987), B.D., Ph.D., *Professor of Old Testament*  
James Michael Efidr (1962), B.D., Ph.D., *Professor of Biblical Interpretation*  
Donn Michael Farris (1950), M.Div., M.S. in L.S., *Professor of Theological Bibliography*  
Mary McClintock Fulkerson (1983), M.Div., Ph.D., *Assistant Professor of Theology*  
Paula E. Gilbert (1985), M.Div., Ph.D., *Instructor in American Christianity*  
† Stanley Hauerwas (1984), B.D., M.A., M.Phil., Ph.D., *Professor of Theological Ethics*  
Frederick Herzog (1960), Th.D., *Professor of Systematic Theology*  
Susan A. Keefe (1988), M.A., Ph.D., *Assistant Professor of Church History*  
Thomas A. Langford (1956), B.D., Ph.D., D.D., *William Kellon Quick Professor of Theology and Methodist Studies*  
Richard Lischer (1979), M.A., B.D., Ph.D., *Associate Professor of Homiletics*  
George Marsden (1986), B.D., Ph.D., *Professor of the History of Christianity in America*  
Paul A. Mickey (1970), B.D., Ph.D., *Associate Professor of Pastoral Theology*  
Carol M. Noren (1986), M.Div., Ph.D., *Assistant Professor of Homiletics*  
Russell E. Richey (1986), B.D., Ph.D., *Research Professor of Church History*  
Grant S. Shockley (1983), M.Div., Ed.D., *Professor of Christian Education*  
Dwight Moody Smith, Jr. (1965), B.D., Ph.D., *George Washington Ivey Professor of New Testament*  
† Harmon L. Smith (1962), B.D., Ph.D., *Professor of Moral Theology*  
William E. Smith (1989), S.T.B., Th.D., D.D., *Professor of the Practice of Christian Ministry*  
David Curtis Steinmetz (1971), B.D., Th.D., *Amos Ragan Kearns Professor of the History of Christianity*  
Karen Westerfield Tucker (1989), M.Div., *Instructor in Liturgics*  
William C. Turner, Jr. (1982), M.Div., Ph.D., *Assistant Research Professor of Theology and Black Church Studies*  
Dan O. Via (1984), B.D., Ph.D., Litt.D., *Professor of New Testament*  
\* Geoffrey Wainwright (1983), B.D., Th.D., *Professor of Systematic Theology*  
John H. Westerhoff III (1974), S.T.B., Ed.D., *Professor of Religion and Education*  
William H. Willimon (1984), M.Div., S.T.D., *Professor of Christian Ministry*  
Robert L. Wilson (1970), B.D., M.A., Ph.D., *Professor of Church and Society*

## FACULTY, DEPARTMENT OF RELIGION

*(Teachers in graduate program in religion whose courses are open to Divinity School students.)*

- Kalman Bland (1973), Ph.D., *Associate Professor of Judaic Studies*  
Elizabeth Clark (1982), Ph.D., *Professor of History of Christianity*  
Roger Corless (1970), Ph.D., *Associate Professor of History of Religions*  
Hans Hillerbrand (1988), Ph.D., *Professor of Religion*  
Wesley A. Kort (1965), Ph.D., *Professor of Religion and Literature*  
Bruce B. Lawrence (1971), Ph.D., *Professor of History of Religions*  
C. Eric Lincoln (1976), Ph.D., *Professor of Sociology of Religion*  
Carol L. Meyers (1979), Ph.D., *Assistant Professor of Old Testament*  
Eric M. Meyers (1969), Ph.D., *Professor of Judaic Studies*  
Robert T. Osborn (1954), Ph.D., *Professor of Theology*  
Harry B. Partin (1964), Ph.D., *Associate Professor of History of Religions*  
Melvin K. H. Peters (1983), Ph.D., *Associate Professor of Old Testament*  
Sandra P. Robinson (1983), Ph.D., *Assistant Professor of History of Religions*  
Kenneth J. Surin (1987), Ph.D., *Associate Professor of History of Religions*  
Orval Wintermute (1958), Ph.D., *Professor of Old Testament*

## RELATED FACULTY

- Albert F. Fisher (1974), M.Div., D.D., *Adjunct Professor of Parish Work*  
W. Kenneth Goodson (1978), B.D., D.D., *Bishop-in-Residence*  
James L. Travis III (1987), M.Div., Ph.D., *Chaplain Supervisor of Duke Medical Center and Clinical Professor of Pastoral Care*

\*Sabbatical leave, fall 1989.

†Sabbatical leave, spring 1990.

## EMERITI

Frank Baker (1960), B.D., Ph.D., *Professor Emeritus of English Church History*  
Waldo Beach (1946), B.D., Ph.D., *Professor Emeritus of Christian Ethics*  
Robert Earl Cushman (1945), B.D., Ph.D., D.H.L., *Research Professor Emeritus of Systematic Theology*  
William David Davies (1966), M.A., F.B.A., D.Litt., *George Washington Ivey Professor Emeritus of Advanced Studies and Research in Christian Origins*  
Stuart C. Henry (1959), B.D., Ph.D., *Professor Emeritus of American Christianity*  
Osmond Kelly Ingram (1959), B.D., *Professor Emeritus of Parish Ministry*  
William Arthur Kale (1952), B.D., D.D., *Professor Emeritus of Christian Education*  
Creighton Lacy (1953), B.D., Ph.D., *Professor Emeritus of World Christianity*  
Roland E. Murphy (1971), M.A., S.T.D., S.S.L., *George Washington Ivey Professor Emeritus of Biblical Studies*  
M. Wilson Nesbitt (1958), B.D., D.D., *Adjunct Professor Emeritus of the Work of the Rural Church*  
Ray C. Petry (1937), Ph.D., LL.D., *James B. Duke Professor Emeritus of Church History*  
McMurry S. Richey (1954), B.D., Ph.D., *Professor Emeritus of Theology and Christian Nurture*  
Charles K. Robinson (1961), B.D., Ph.D., *Associate Professor Emeritus of Philosophical Theology*  
John Jesse Rudin II (1945), B.D., Ph.D., *Associate Professor Emeritus of Liturgy and Worship*  
William Franklin Stinespring (1936), Ph.D., *Professor Emeritus of Old Testament and Semitics*  
Franklin Woodrow Young (1968), B.D., Ph.D., *Amos Ragan Kearns Professor Emeritus of New Testament and Patristic Studies*

## BOARD OF VISITORS

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Arch G. Mainous, Jr. (1990), Louisville, Kentucky  
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Professor C. G. Newsome (1991), Washington D.C.  
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M. Sherrill Williams (1988), Newton Grove, North Carolina  
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# Duke University

DURHAM  
NORTH CAROLINA  
27706

The Divinity School  
Office of the Dean

TELEPHONE (919) 684-4041

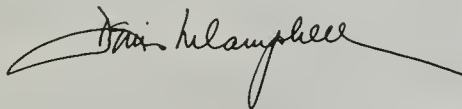
The Divinity School was the first of Duke University's graduate professional schools to open its doors after the university was founded. This priority is indicative of the central role the school plays in the total university. We take our university setting seriously and believe that the advantages of theological education in the middle of Duke University are considerable.

The quality of our student body has never been better. We enroll 391 students in the professional degree programs (M.Div., M.T.S., M.R.E., and Th.M) and an additional 80 students in the M.A./Ph.D. program. Our students are men and women from almost 200 undergraduate schools, 32 denominations, 38 states and 7 foreign countries. Women constitute approximately 35 percent of the total enrollment, and black students almost 10 percent. Most of our students receive substantial financial support in the form of scholarships and grants-in-aid, this year a total of \$1.1 million. Duke's program of financial aid is rightfully renowned.

While the accomplishments of its distinguished faculty and aggressive international programs earn it increasing prominence in theological education and the ecumenical world, the Divinity School enjoys exceptionally strong regional, denominational and alumni support as well.

Duke's unique field education program features grants-in-aid for vocational preparation. The program's funding from The Duke Endowment makes it possible for our students to advance their competency in ministry while receiving substantial financial assistance.

We are a school of the Church and of the university; we are a school in the Wesleyan tradition and in the ecumenical tradition; we are a school committed to professional education for the practice of lay and ordained ministries and to graduate theological education, research and scholarship. These are exciting times at the Divinity School as we seek bold and imaginative initiatives equal to the challenges of the late twentieth century.



Dennis M. Campbell  
Dean

*General Information*



## History

Duke University as it exists today developed from simple beginnings. Established in 1838, Union Institute became Normal College by 1851 and in 1859 was renamed Trinity College. In 1892 the college moved to Durham, North Carolina.

In 1924 James B. Duke established a trust fund for educational and charitable purposes. The chief beneficiary was Trinity College, which became Duke University. The purpose for establishing the trust was very clear: "I have selected Duke University as one of the principal objects of this trust because I recognize that education, when conducted along sane and practical, as opposed to dogmatic and theoretical lines, is, next to religion, the greatest civilizing influence. . . . And I advise that the courses at this institution be arranged, first, with special reference to the training of preachers, teachers, lawyers, and physicians, because these are most in the public eye, and by precept and example can do most to uplift mankind." The School of Religion began its work in the academic year 1926-27, and formal exercises for its opening were held on 9 November 1926. In 1940 the name was changed to the Divinity School.

During its history the Divinity School has had outstanding teachers, scholars, and administrative leaders,\* and its graduates have distinguished themselves by making significant contributions to the Church and the world. In 1964 a program of expansion was begun, culminating in February, 1972, when the Divinity School doubled its physical facilities and moved into a new building.

## The Role of the Divinity School

The Divinity School represents theological inquiry and learning within the greater university. By history and indenture, it stands within the Christian tradition, mindful of its distinctive lineage in and its continuing obligation to the United Methodist Church. The Divinity School, although United Methodist in tradition and dependency, receives students from many Christian denominations and offers its educational resources to representatives of the several communions who seek an education for church-related ministry. From its inception, it has been ecumenical in aspiration, teaching, and practice,

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\*Since the institution of the school in 1926, the following persons have served as deans or acting deans: Edmund Davidson Soper, 1926-28; Elbert Russell, 1928-41; Paul Neff Garber, 1941-44; Harvie Branscomb, 1944-46; Gilbert T. Rowe, Acting Dean of the Faculty, 1946-47; Paul E. Root (elected in 1947 but died before assuming office); Harold A. Bosley; 1947-50; James Cannon III, acting dean 1950-51, dean 1951-58; Robert Earl Cushman, 1958-71; Thomas A. Langford, 1971-81; Jameson Jones, 1981-82; Dennis M. Campbell, 1982-.



as well as in its faculty. Educational policy has consistently aspired to foster a Christian understanding "truly catholic, truly evangelical, and truly reformed."

The principal purpose of the Divinity School is the professional education for the ministry, which in today's world is manifested in a variety of forms. Although the conventional and inherited styles of ministry are now undergoing change, the Divinity School curriculum continues to prepare students for informed and discriminating discharge of the historic offices of church and congregation through the ministry of word and sacrament, pastoral care, and teaching. The Divinity School believes these offices will remain, although the form and context of the local church may change.

With this in mind, the Divinity School seeks to prepare men and women for the mature performance of their vocation. It hopes to develop in each student a disciplined faith, informed by sound learning and equipped for worthy professional service. Its resources are offered to students with a diversity of ministerial aims, although the school seeks, by recruitment and financial support, to prepare persons for ordination or lay professional vocations in the churches. In all its endeavors, the Divinity School aims to serve Jesus Christ through service to the Church and the world.

## **The Relation of the Divinity School to Duke University**

The Divinity School is an integral part of the university and shares fully in its activities, privileges, and responsibilities. The Sunday services in the University Chapel give Divinity School students each year an opportunity to hear several of the country's leading preachers. The university libraries make a rich collection of books and other materials easily accessible. Without paying additional fees, selected courses in the graduate and professional schools are open to Divinity School students, as well as the general, cultural, and recreational resources of the university.

## **Library Resources**

**Divinity School Library.** The Divinity School Library contains a collection of more than 250,000 volumes in the field of religion and related disciplines and affords an unusual wealth of material for the seminary student. Although an integral part of the university's twelve-unit library system, which possesses more than 3,625,000 volumes, the Divinity School Library has its own separate facilities in the Divinity School building. Its book collection is operated on the open stack system, and its reading rooms provide study facilities for students, space for the special reference collection in religion, and for the more than 600 religious periodicals to which the library currently subscribes.

Staffed by a librarian and a reference librarian trained in both theology and library administration, by a supporting staff of three persons, and by a number of student assistants, the library offers a variety of reference services to assist the student in selecting and locating materials. The staff, in cooperation with the faculty, maintains a book and periodical collection to support basic course work as well as advanced research in all major fields of religious studies.

The Divinity School Library is adjacent to the Perkins Library. The seminary student may use the resources and facilities of the Perkins Library, some of which include manuscripts, archives, public documents, newspapers, periodicals, microfilms, maps, rare materials (among which are eighty-one prized ancient Greek manuscripts), and reference assistance. There is a provision for borrowing books from the libraries of the University of North Carolina and other neighboring institutions.

## **The Henry Harrison Jordan Loan Library**

Henry Harrison Jordan, (1862-1931), distinguished member of the Western North Carolina Conference, was memorialized by his children by the establishment of an endowment in 1947. The Divinity School librarian is the custodian of books purchased

under this fund for loan, through postal services, to qualified ministers of all denominations or localities. The Jordan Loan Library maintains a catalogue of up-to-date publications representative of the several theological disciplines and areas of the minister's professional interest. Books may be borrowed by application to the librarian of the Divinity School.

## Library Funds

The following funds provide resources to enrich the collections of the Divinity School Library.

**The Ormond Memorial Fund** was established in 1924 by Dr. J. M. Ormond, Trinity College Class of 1902, and Mrs. Ormond, in memory of his parents, Mr. and Mrs. J. J. Ormond. The fund income maintains the collection of books on the rural church.

**The Avera Bible Fund** was established in 1895 by a gift of Mrs. L. B. McCullers in memory of her husband, Willis H. Avera. The income is for the purchase of books for the Divinity School Library and for the support of the Avera Bible Lectures.

**The Louis W. Bailey Memorial Fund** was established in 1958 by the Reverend Dr. A. Purnell Bailey, Class of 1948, in memory of his father. The income is to be used for books for the Divinity School Library.

**The Stuart C. Henry Collection Endowment Fund** was established by the Class of 1975 to honor Professor Henry. Income from the fund is used to enhance the collection on American Christianity. Substantial additional contributions to this fund have been made by Miss Marion D. Mullins of Fort Worth, Texas.

**The William Arthur Kale, Jr. Memorial Fund** was established in 1964 by Professor and Mrs. William Arthur Kale, Sr., for the purchase of books and other materials in the area of fine arts and religious musicology for the perpetual enrichment of the holdings of the Divinity School Library. William Arthur Kale, Jr., was a member of the Duke University Chapel Choir.

**The Walter McGowan and Minnie Daniel Upchurch Fund** was established in 1971 by W. M. Upchurch, Jr., an alumnus of Duke University and a member of its Board of Trustees, in honor of his parents. The fund income is used for the purchase of materials in the area of sacred music and is supplementary to a collection of materials given by Mr. Upchurch to the Divinity School Library. This collection includes anthems and other compositions of sacred music, along with 62 disc recordings of the Duke University Summer Chapel Choir for the years 1932-41 when Mr. Upchurch was director of the choir.

## Center for Studies in the Wesleyan Tradition

The Center for Studies in the Wesleyan Tradition was founded in 1979 and is supported by a permanent endowment of the Divinity School designated for its use. The center supports a wide variety of programs designed to advance teaching, research, and publication in Wesleyan history and theology.

**Library.** The Baker Collection is one of the two largest collections of Wesley and Methodist materials extant. Named for Professor Emeritus Frank Baker, the world's foremost authority on John Wesley, and editor of the bicentennial edition of Wesley's Works, a project based at Duke Divinity School, the Baker Collection is an unparalleled resource.

**Visiting Professors.** The center brings distinguished visiting professors to teach in the Divinity School. Recently, Dr. David Stacey, principal of Wesley College, Bristol, England, and Dr. José Miguez Bonino, professor of theology and ethics at the Protestant Theological Seminary in Buenos Aires, Argentina served in this capacity.



*Stanley Hauerwas, Professor of Theological Ethics*

**Visiting Scholars.** The center makes research grants to scholars from around the world to work for various periods of time in the Divinity School. Among those who have served recently are Bishop Ole Borgen, United Methodist Bishop of Sweden, Norway, Denmark, Finland, and Estonia, and Professor Morna Hooker, Lady Margaret Professor of Divinity, Cambridge University, England.

**Visiting Lecturers.** The center has an extensive program of visiting lecturers which exposes students and faculty of the Divinity School to leading figures in the Wesleyan tradition from throughout the world. Most recently these included: Professor Peder Borgen, University of Trondheim, Norway; Dr. Manfred Marquardt, the Methodist Theological Seminary, Reutlingen, West Germany; Dr. Rutiger Minor, the Methodist Seminary in East Germany; the Reverend Helmut Nausner, district superintendent, Vienna, Austria; Professor Norman Young, principal of Queens College, the University of Melbourne, Australia; and Dean Walter Klaiber, Methodist Theological Seminary, Rentingon, West Germany.

**Publications.** The center is committed to a program of scholarly publication. In 1983, support was given for preparation of a reader in theology in the Wesleyan tradition.

**Faculty Committee.** Divinity School faculty related to the center include Professor Thomas A. Langford, Professor Geoffrey Wainwright, Professor Robert L. Wilson, Bishop W. Kenneth Goodson, and Professor Dennis M. Campbell, dean and chairman.







*Faculty*



*Faculty process into Duke Chapel*

## Faculty

The faculty of Duke University Divinity School is regarded as one of the world's strongest theological faculties. The faculty is committed to excellence in teaching, research, publication, and service to the Church, the university, and the wider community. The Duke faculty is particularly well-known for its strong commitment to the Church and its ministry. The faculty is very diverse. It includes persons who come from all over the United States and the world. Virtually all major Christian traditions are represented, and identity with specific communities within the Christian tradition is taken seriously by faculty members. Because of its distinguished faculty, the Divinity School is an international center for research and publication in the theological disciplines and for reflection on the practice of ministry in the late twentieth century.

## Faculty Biographical Information

**Lloyd Richard Bailey**, *Associate Professor of Old Testament*. B.A., B.D. (Duke University); Ph.D. (Hebrew Union College-Jewish Institute of Religion).

Professor Bailey's academic interests include biblical studies (primarily Pentateuch and Prophetic literature), the problem of utilizing ancient texts as Scripture (text to sermon), ancient Near Eastern civilization and archaeology, and perspectives on aging, dying, and death. In these areas he has written and edited nearly two dozen books, more than thirty articles in journals and encyclopedias, and has prepared curriculum and media units for the United Methodist Church. He currently serves on the editorial boards of *Biblical Archaeologist* and *Quarterly Review*, is a past president of the Society of Biblical Literature (Southeastern Region), and is an elder in the Western North Carolina Annual Conference of the United Methodist Church. Prior to joining the Duke faculty, he taught at Union Theological Seminary in New York.

**Teresa M. Berger**, *Assistant Professor of Ecumenical Theology*. M.Th. (Mainz University, West Germany); L.Th. (St. John's College, Nottingham, England); Ph.D. (University of Heidelberg).

Professor Berger's academic interests are in ecumenical and liturgical theology. Her published research includes studies on the liturgical thinking of nineteenth-century Tractarianism, as well as on an ecumenical theology of worship, and on women and worship. She held a visiting position at the Roman Catholic faculty of the University of Mainz (West Germany), where she taught liturgical theology. She currently is a council member of *Societas Liturgica*, and is on the editorial board of *Studia Liturgica*, of which she is the review editor. Dr. Berger is a Roman Catholic who (as part of a lived ecumenical theology) currently lives and worships within the Eastern Orthodox tradition.

**Dennis M. Campbell**, *Dean of The Divinity School and Professor of Theology*. A.B. (Duke University); B.D. (Yale University); Ph.D. (Duke University); D.D. (Florida Southern).

Dean Campbell teaches in systematic theology. His particular research interests are in ecclesiology, including theology of ministry, and ethics. Professor Campbell's books include *Authority and the Renewal of American Theology*; *Doctors, Lawyers, Ministers: Christian Ethics in Professional Practice*; and *The Yoke of Obedience: The Meaning of Ordination in Methodism*. He has written numerous articles for journals and is widely in demand as a lecturer and preacher. Prior to his appointment at Duke he served as a pastor and as a professor at the undergraduate level. Dr. Campbell is an elder in the United Methodist Church. He has twice been a delegate to General Conference and is a member of the World Methodist Council. He serves on the Accrediting Commission of the Association of Theological Schools in the U.S. and Canada. Through his participation in several major academic boards, Dean Campbell is a national leader in U.S. higher education.

**Jerry D. Campbell**, *Professor of the Practice of Theological Bibliography*. B.A. (McMurry College); M.Div., (Duke University); M.S. (University of North Carolina); Ph.D. (University of Denver).

Dr. Campbell's principal efforts are directed toward insuring that the Divinity School provides the resources necessary to support the research and study of faculty and students. He is concerned both with bringing resources to the Divinity School Library and with making them available for use as quickly as possible. His interests range from scholarly publishing to the computer automation of library practices. He also serves the wider university as vice-provost for library affairs and university librarian. Dr. Campbell, an ordained United Methodist clergyman, is a member of the University United Methodist Church Charge Conference in Chapel Hill. In University United Methodist Church, he chairs the Church and Society Work Area, occasionally teaches Sunday School, and assists the staff in other ways as needed.

**Ted A. Campbell**, *Assistant Professor of Church History*. B.A. (North Texas State University); B.A./M.A. (Oxford University); Ph.D. (Southern Methodist University).

Professor Campbell teaches principally in the area of post-Reformation European and British Church history, with a focus on Wesley studies. He is the author of *The Apostolate of United Methodism*, and has published articles in *Church History*, *The Wesleyan Theological Journal*, *Circuit Rider*, and the *AME Zion Quarterly Review*. Prior to his joining the Divinity School faculty in 1985, Professor Campbell served church appointments in Texas and taught for a year as visiting lecturer at the Methodist Theological School in Ohio.

**James L. Crenshaw**, *Professor of Old Testament*. B.A. (Furman University); B.D. (Southern Baptist Theological Seminary); Ph.D. (Vanderbilt University).

Professor Crenshaw's academic interests are in literary and theological interpretations of the Hebrew Bible. He teaches courses on biblical theology, wisdom and prophetic literature, prayer in the Old Testament, narrative art in the Hebrew Bible, the problem of evil, Job, Ecclesiastes, Proverbs, and introduction to the literature and history of ancient Israel. Among his publications are *Prophetic Conflict*, *Samson*, *Old Testament Wisdom*, *A Whirlpool of Torment*, *Ecclesiastes*, and *Story and Faith*. A former editor of the Society of Biblical Literature Monograph Series, he currently edits a series entitled "Personalities of the Old Testament." A Baptist minister, he has been active in Baptist and Christian (Disciples of Christ) churches for over three decades. Before joining the Duke faculty, Professor Crenshaw taught at Atlantic Christian College, Mercer University, and Vanderbilt Divinity School.

**James Michael Efird**, *Professor of Biblical Interpretation*. A.B. (Davidson College); M.Div. (Louisville Presbyterian Theological Seminary); Ph.D. (Duke University).

Having served on the Duke Divinity School faculty since 1962, Professor Efird has concentrated on making biblical scholarship understandable and useful for men and women preparing primarily for parish ministry. In addition, he has taken this approach to the laity of the church in many different denominations. Professor Efird's teaching, research, and writing cover the broad spectrum of both the Old and the New Testaments and are reflected in eleven books and in over fifty articles in various journals and Bible dictionaries. Currently he is serving as editor of the Contemporary Christian Concerns series ("What the Bible Says") from Abingdon Press.

**Donn Michael Farris**, *Professor of Theological Bibliography*. B.A. (Berea College); M.Div. (Garrett-Evangelical Theological Seminary); M.S. in Library Science (Columbia University).

The senior member of both the Divinity School faculty and the university library staff, Professor Farris came to Duke in 1950 and has directed the growth of the Divinity School Library from 48,000 volumes at that time to its present size of more than a quarter of a million. He is a past president of the American Theological Library Association and is a member of its Board of Directors. He founded the association's official quarterly publication, the *ATLA Newsletter*, in 1953, and has edited it continuously for the past thirty-five years.

**Albert F. Fisher**, *Adjunct Professor of Parish Work*. A.B. (Duke University); B.D. (Duke University); D.D. (North Carolina Wesleyan College).

Albert Fisher has worked with the Rural Church Division of The Duke Endowment since 1974, serving as director since 1977. As Director of the Rural Church Division, he is responsible for making requests to the trustees of The Duke Endowment from eligible beneficiaries. Many of the grants made through the Rural Church Division are made to Duke Divinity School or to students in the Divinity School who serve as student pastors or assistant pastors in rural United Methodist churches in North Carolina. Prior to joining The Duke Endowment, Fisher



was a pastor and a district superintendent in the North Carolina Conference. He is a member of the Board of Visitors of Duke Divinity School, a past president of the Divinity School Alumni Association, and a past president of the Duke University General Alumni Association.

**Mary McClintock Fulkerson**, *Assistant Professor of Theology*. B.M. (University of North Carolina at Chapel Hill); M.Div. (Duke University); Ph.D. (Vanderbilt University).

Professor McClintock Fulkerson's primary teaching interests are nineteenth-century German Protestant thinkers and contemporary Protestant theology, focusing on authority in theology, ecclesiology, and feminist theologies. Her current research is in the role of tradition and Scripture in feminist theologies. Ordained in the Presbyterian Church, U.S.A., she was a pastor before coming to Duke. She is a member of Presbytery's Examination Committee and of the Committee on Ministry Design of the national Presbyterian Church, U.S.A.

**Paula E. Gilbert**, *Instructor in American Christianity, and Assistant Dean for Planning and Special Projects*. B.A. (Huntingdon College); M.Div., Ph.D. (Duke University).

Professor Gilbert's academic interests are in American religious thought and British and American Methodism. Having written about Georgia Harkness for her dissertation, she is also concerned about women and the church, religion and war, and ecumenism. Joint author of *Pastoral Assertiveness: A New Model for Pastoral Care*, Professor Gilbert is also minister to York Chapel and director of the Ministerial Course of Study School at Duke. She is a member of the Board of Advisors for the Intentional Growth Center of the Southeastern Jurisdiction of the United Methodist Church and coordinator for the 1988 revision of the correspondence Course of Study School curriculum for the United Methodist Church. Dr. Gilbert is an elder in the Alabama-West Florida Annual Conference.

**Stanley M. Hauerwas**, *Professor of Theological Ethics*. B.A. (Southwestern University); B.D., M.A., M.Phil., Ph.D. (Yale University).

Professor Hauerwas works in the field of theological ethics where he has sought to recover the significance of the virtues for understanding the nature of the Christian life. This has led him to emphasize the importance of the Church as well as narrative for understanding the nature of Christian existence. His work has been characterized by cutting across disciplinary lines as he is in conversation with systematic theology, philosophical theology, philosophical ethics and political theory, as well as the philosophy of social science. He has published several books, but perhaps the best known are *The Peaceable Kingdom* and *A Community of Character*. He lectures widely to church and academic audiences but his work clearly indicates his fundamental interest is in the up-building of moral discourse within the contemporary Christian community. Professor Hauerwas is a lay member of Resurrection United Methodist Church in Durham.

**Frederick Herzog**, *Professor of Systematic Theology*. Th.D. (Bonn University, Basel University); Th.M., Th.D. (Princeton Theological Seminary); D. Theol. (Bonn University).

Prior to joining The Divinity School faculty in 1960, Professor Herzog was pastor in his native North Dakota and on the faculty of what is now United Theological Seminary of the Twin Cities. His research centers in nineteenth-century Protestant thought, the polarization of systematics and dogmatics, philosophical method in religious studies and the development of a new paradigm of theology. Since the civil rights era he has shaped liberation theology as hermeneutical focus in the North American context. His publications include *Understanding God, Liberation Theology, Justice Church*, and *God-Walk: Liberation Shaping Dogmatics*. As member of Commissions of the United Church of Christ (and World Council of Churches) he has worked on concrete ecumenical union, doctrinal renewal, and globalization of theological education. He is also a member of the Oxford Institute of Methodist Theological Studies. Professor Herzog is an ordained minister of the United Church of Christ.

**Susan A. Keefe**, *Assistant Professor Church History*. Ph.D. (University of Toronto).

Dr. Susan A. Keefe joins the faculty as assistant professor of Church History after a year as an Andrew W. Mellon Faculty Member in the Humanities at Harvard. Prior to that she taught at Davidson. She received her doctorate in Medieval Studies from the Centre for Medieval Studies, University of Toronto, in 1981. Her dissertation and publications examine the teaching and celebration of the sacraments of Christian initiation across Carolingian Europe using baptismal instructions written for parish priests.

**Thomas A. Langford**, *William Kellon Quick Professor of Theology and Methodist Studies*. B.A. (Davidson College); B.D., Ph.D. (Duke University); D.D. (Davidson College).

Professor Langford's academic interests are in systematic and philosophical theology, in British theology, and in theology in the Wesleyan tradition. He attempts especially to explore the relation of theology to culture. *Philosophy of Religion, Intellect and Hope, Practical Divinity, Christian Wholeness, Prayer and the Common Life*, and *Theology in the Wesleyan Tradition: A Sourcebook* are among his publications. Activity in the university as vice-provost and in the United Methodist Church also expresses his interests. He helped write the section on ministry in *The Book of Discipline of the United Methodist Church* and is the principal author of the current statement on the mission of the Church. An elder in the Western North Carolina Conference, he has served as a delegate to Jurisdictional and General Conferences since 1972. Dr. Langford was dean of the Divinity School 1971-1981.



**Richard Alan Lischer**, *Associate Professor of Homiletics*. B.A. (Concordia Senior College); M.A. (Washington University); B.D. (Concordia Seminary); Ph.D. (University of London).

A native of St. Louis, Professor Lischer's graduate theological training is in systematic theology. He is an ordained minister in the Evangelical Lutheran Church in America and has nine years of pastoral experience in rural and suburban settings. He joined the faculty of the Divinity School in 1979 where he teaches in the areas of homiletics and ministry. In his scholarly work Dr. Lischer has sought to portray proclamation as an integrated theological activity. He has published widely in the areas of theology, ministry, and preaching. His books, *A Theology of Preaching* and *Theories of Preaching* deal with the theological and rhetorical bases of preaching. *Speaking of Jesus* reflects his parish experiences with grassroots evangelism.

**George Marsden**, *Professor of the History of Christianity in America*. A.B. (Haverford College); B.D. (Westminster Theological Seminary); M.A., Ph.D. (Yale University).

Professor Marsden has written and edited books on the history of American evangelicalism and fundamentalism. Currently his research focuses on the secularization of American universities. He is an editor of the *Reformed Journal*. His books include *Fundamentalism and American Culture*, *The Evangelical Mind and New School Presbyterian Experience*, *The Search for a Christian America*, and *Reforming Fundamentalism: Fuller Seminary and the New Evangelicalism*. Before coming to Duke in 1986 he taught for twenty-one years at Calvin College.

**Paul A. Mickey**, *Associate Professor of Pastoral Theology*. B.A. (Harvard University); B.D., Ph.D. (Princeton Theological Seminary).

Prior to joining the Duke faculty, Professor Mickey served pastorates in Ohio and New Jersey, was a chaplain services specialist in the Air Force, and was a behavioral and management consultant for Western Electric Psychological Testing Division. An ordained United Methodist minister, his primary interests are in the areas of marriage and family counseling, developing parish leadership skills, and the intersection of theology and psychology. He has published in the areas of marriage counseling and parish leadership skills. Current areas of interest are in self esteem issues for adults and children, with specific focus on adult children of alcoholics, and the developmental, spiritual, and theological blockages resulting from abusive and obsessive behavior.

**Carol Marie Noren**, *Assistant Professor of Homiletics*. B.A. (Augustana College); M.Div. (Garrett-Evangelical Theological Seminary); Ph.D. (Princeton Theological Seminary).

A native of Illinois, Professor Noren is an elder in the United Methodist Church. She served churches in Manchester, England and in the Northern Illinois Conference before entering Princeton. She was on the faculty of Princeton Theological Seminary prior to coming to the Divinity School. Her academic interests are in the history and theology of preaching, worship in the Wesleyan tradition, and women in preaching. Her current research is on the history of preaching in Swedish-American Methodism. She has preached widely in the United States and England.

**Russell E. Richey**, *Associate Dean for Academic Programs and Research Professor of Church History*. B.A. (Wesleyan University); B.D. (Union Theological Seminary); M.A., Ph.D. (Princeton University).

Before coming to Duke, Professor Richey was on the faculty of Drew University where he taught American church history and served terms as dean of students in the Theological School and assistant to the president. Editor of three books, most recently, *Rethinking Methodist History (1985)*, and of many articles, he has research interests in institutional aspects of American religion and in Methodist history. He teaches in American Christianity and American Methodism. Professor Richey is an elder in the North Carolina Conference of the United Methodist Church.

**B. Maurice Ritchie**, *Associate Dean for Student Life and Director of Field Education*. B.A. (Davidson College); B.D., Th.M. (Duke University).

The Reverend B. Maurice Ritchie specializes in the practice of ministry and the training of persons for ministry in parishes, institutions, chaplaincies, and a variety of other settings. His own experience includes service as a parish minister, as college chaplain, and a professor at the undergraduate level. He previously served the Divinity School as director of admissions and student affairs. He is an elder in the Western North Carolina Conference and a member of the Board of Ordained Ministry of that conference and of the Southeastern Jurisdiction.

**Grant S. Shockley**, *Professor of Christian Education*. A.B. (Lincoln University); M.Div. (Drew University); M.A., Ed.D. (Union Theological Seminary/Columbia University).

Professor Shockley's areas of teaching interest include curriculum development, instructional and learning theory, age-level and family life ministries. His previous teaching positions include Garrett Theological Seminary, Candler School of Theology, Emory University. Dr. Shockley's research interests include black theological education and Methodist history. His many publications include books, chapters, research studies, numerous articles in professional journals and curriculum resource materials. He is a consultant to Protestant church education boards in the United States, Africa, Asia, and Latin America. He has served as a visiting professor at New York University, Northwestern University, Drew University and the University of Zimbabwe.

**Dwight Moody Smith**, *George Washington Ivey Professor of New Testament*. B.A. (Davidson), B.D. (Duke University), M.A., Ph.D. (Yale University).

Professor Smith's *Composition and Order of the Fourth Gospel* appeared in 1965. Subsequently, his contributions to Johannine scholarship have taken the form of articles, essays and reviews, the most notable of which were published in *Johannine Christianity*. His textbook, with Robert A. Spivey, *Anatomy of the New Testament*, has just appeared in a fourth revised edition. *John*, in the Proclamation Commentaries Series, appeared in a revised edition in 1986. He has published *Interpreting the Gospels for Preaching*, as well as articles in the *Interpreter's Dictionary of the Bible*, *Harper's Bible Dictionary*, and *Macmillan's Encyclopedia of Religion*. A postdoctoral fellow of the Lilly Foundation (Zurich Foundation), the Guggenheim Foundation (Cambridge University), and the Association of Theological Schools, from 1960 to 1965, he previously taught at the Methodist Theological School in Ohio. He is an elder in the South Carolina Annual Conference.

**Harmon L. Smith**, *Professor of Moral Theology and Professor of Community and Family Medicine*. B.A. (Millsaps College); B.D., Ph.D. (Duke University).

Professor Smith's teaching centers in systematic Christian ethics and medical ethics. His principal research interests are in ethical method, decision theory, and ethics and medicine. He has been a visiting professor in several universities both here and abroad, and has lectured in more than 150 colleges and universities, and more than 75 hospitals and medical schools, in the U.S., Canada, and Europe. His most recent book is *Professional Ethics and Primary Care Medicine* (with Larry Churchill). He is a priest of the Episcopal Church, canonically resident in the Diocese of North Carolina, and currently interim rector of St. Titus' Church, Durham.

**David C. Steinmetz**, *Amos Ragan Kearns Professor of the History of Christianity*. B.A. (Wheaton College); B.D. (Drew University); Th.D. (Harvard University).

Professor Steinmetz is a specialist in the history of Christianity in the later middle ages and Reformation. Before coming to Duke in 1971, he taught at Lancaster Theological Seminary of the United Church of Christ. In 1977 he was a Visiting Professor at Harvard University and a Guggenheim Fellow at Cambridge University. A former president of the American Society of Church History (1985), he has written numerous books and articles in his field, including *Luther and Staupitz* (1980), *Luther in Context* (1986) and *Memory and Mission: Theological Reflections on the Christian Past* (1988). He is a United Methodist minister and a member of the North Carolina Conference.

**James L. Travis III**, *Clinical Professor of Pastoral Care*. B.A. (Mississippi College); B.D., Th.M. (Southern Baptist Theological Seminary); Ph.D. (Emory University).

Professor Travis' clinical and academic interests have blended over twenty-five years of pastoral care and education in psychiatric and general hospitals. Earlier publications address issues such as New Testament implications for pastoral care and counseling, and liturgical worship in a psychiatric hospital. Certified as a chaplain supervisor by the Association for Clinical Pastoral Education, he is interested in the formation and development of persons in the pastoral role, and medical ethics and pastoral care. His research interests include the relationship of pastoral care to health care and the measurement of objectives in CPE programs. Dr. Travis is chaplain to Duke University Hospital and director of chaplain services at Duke University Medical Center.

**William C. Turner, Jr.**, *Assistant Research Professor of Theology and Black Church Studies*. B.S., M.Div., Ph.D. (Duke University).

Professor Turner held positions within Duke University in student affairs and Afro-American studies before joining the Divinity School faculty. His ongoing work focuses on pneumatology and the tradition of spirituality and preaching within the black church. Upcoming articles on "Black Evangelicalism," "The Musicality of Black Preaching," and "The Black Church and the Ecumenical Tradition" reflect his teaching and writing interests. Professor Turner travels widely as a preacher and lecturer. He retains active involvement in church and community activities.

**Dan O. Via**, *Professor of New Testament*. B.S. (Davidson College); B.D. (Southern Baptist Theological Seminary); Ph.D. (Duke University), Litt. D. (Davidson College).

Professor Via's teaching and research interests focus on the parables of Jesus, the Gospels of Mark and Matthew, New Testament theology and ethics, and hermeneutics; and his primary method of interpretation has been to use existential thinking and literary criticism as a means for articulating the theological meaning of the New Testament. Among his publications are *The Parables* and *The Ethics of Mark's Gospel*. His current project is a study of the problem of self-deception as it appears in the writings of Paul and the Gospel of Matthew. He has held visiting professorships recently at the University of Zimbabwe and at Harvard Divinity School. He is an ordained Baptist minister and preaches in various churches and lectures to ministerial groups.

**Geoffrey Wainwright**, *Professor of Systematic Theology*. B.A., M.A., B.D., D.D. (University of Cambridge); Th.D. (University of Geneva).

A minister of the British Methodist Church, Dr. Wainwright taught theology in Cameroon, West Africa (1967-73), Birmingham, England (1973-79), and Union Theological Seminary, New York (1979-83). He is author of *Eucharist and Eschatology* and of *Doxology*, and editor of *The Study of Liturgy* and *The Study of Spirituality*, all published by Oxford University Press. He is a member of the Faith and Order Commission of the World Council of

Churches and currently chairs the international dialogue between the World Methodist Council and the Roman Catholic Church. His churchly interests are reflected in his book *The Ecumenical Moment* and another on *Wesley and Calvin as Sources of Theology, Liturgy and Spirituality*. He teaches across the entire range of Christian doctrine and is particularly interested in the truth claims of faith and theology.

**John H. Westerhoff III**, *Professor of Religion and Education*. B.S. (Ursinus College); S.T.B., (Harvard University); Ed.D. (Columbia University).

Professor Westerhoff is best known for his numerous books, of which *Will Our Children have Faith?* has become a classic. Having taught at various universities including Harvard, Princeton, Fordham, and Boston College, he has been at Duke for fifteen years, where he has focused his scholarship and teaching on Christian formation, education, and instruction. For the past ten years he has been editor of the journal *Religious Education*. As a practical theologian he is concerned about the intersection of various aspects of ministry such as liturgics, pastoral care, and spirituality. An Episcopal priest, he assists at the Chapel of the Cross in Chapel Hill, North Carolina. A popular speaker and workshop leader, he travels throughout the world working with clergy and laity from many traditions.

**William H. Willimon**, *Professor of Christian Ministry*. B.A. (Wofford College); M.Div. (Yale University); S.T.D. (Emory University).

Professor Willimon teaches courses in preaching and worship in addition to his duties as minister to the university. Before coming to Duke, he served as pastor in churches in Georgia and South Carolina. His research and publication includes work in liturgics, homiletics, and pastoral care. He is the author of twenty-six books, two of which have been selected by the Academy of Parish Clergy as the most useful book for pastors in the year in which they were published. He has served the Church as an editor of new worship resources, curriculum writer, and as a member of the United Methodist Commission on Worship. He is on the editorial board of three professional journals, including *Quarterly Review* and the *Christian Century*, and has lectured in the United States, Korea, and Europe. He is an elder in the South Carolina Conference of the United Methodist Church.

**Robert L. Wilson**, *Professor of Church and Society*. A.B. (Asbury College); M.A. (Lehigh University); B.D. Garrett-Evangelical Theological Seminary; Ph.D. (Northwestern University).

Professor Wilson's research interests focus on the relationship between church and community, the sociology of religious institutions, congregational planning and United Methodist polity. His major publications are: *Faith and Form: A Unity of Theology and Polity in the United Methodist Tradition* (with Steve Harper), *Rekindling the Flame: Strategies for a Vital United Methodism* (with W. H. Willimon), *Shaping the Congregation, Preaching and Worship in the Small Church* (with Willimon), and *What's Ahead for Old First Church* (with E. E. Jones). He is the author of numerous articles and research reports. For twelve years prior to coming to Duke, he served as director of research for the National Division of the Board of Missions. An elder in the North Carolina Conference of the United Methodist Church, he is the director of the J. M. Ormond Center for Research Planning and Development at Duke University.







*Admissions*



## Requirements and Procedures

The Divinity School is a fully accredited member of the Association of Theological Schools and is one of thirteen accredited seminaries of the United Methodist Church. It considers candidates for admission who hold an A.B. degree, or its equivalent, from a college approved by a regional accrediting body.

**Preseminary Curriculum.** The Divinity School follows the guidelines of the Association of Theological Schools with respect to undergraduate preparation for theological study. In general, this means a strong background in liberal arts, especially the humanities. A well-rounded background in English language and literature, history, philosophy, psychology, religion, social science, and foreign languages is especially desirable.

**Application Procedures for Master of Divinity and Master of Religious Education Programs.** Application forms secured from the admissions office should be filed six to twelve months in advance of the intended date of enrollment. Ordinarily, no application for a degree program will be accepted after 15 May and 1 November for August and January enrollments, respectively. The student should provide the following supporting documents and information: (1) one copy of the official transcript from each college, university, or seminary attended sent by the institution directly to the director of admissions; (2) one supplementary transcript, sent as soon as possible, showing completion of work which was in progress when the earlier transcript was made; and (3) the names of five persons who are best qualified to judge the applicant as a prospective student in the Divinity School and who will be contacted by the school for written letters of recommendation. Of these five references, two or three should be academic and two or three should be general, including a home pastor or official denominational representative. *Materials submitted in support of an application are not released for other purposes and cannot be returned to the applicant.*

Applicants are strongly urged to come for on-campus visits and interviews prior to final admission. *A minimum of thirty days is required to process any application for a degree program.*

Graduates of unaccredited senior colleges and universities may apply for admission, but will be considered for admission only on a limited program basis (see next page).

**Admission Requirements.** Those persons are encouraged to apply:

1. who have or will have been awarded a bachelor's degree from a regionally accredited college or university prior to their intended date of enrollment;
2. who have attained at least an overall B- (2.65 on 4.0 scale) academic average; and

3. who are committed to some form of ordained or lay ministry.

*Applicants are evaluated on the basis of academic attainment, future promise for ministry, and vocational clarity and commitment.*

**Admission on Limited Program.** Limited program is a special relation between the school and the student, designed to encourage and support academic achievement. Students may be admitted on limited program for a number of reasons including an undergraduate degree in a program other than liberal arts, an undergraduate degree from a nonaccredited college, or an undergraduate transcript that does not fully meet Divinity School standards.

Limited program means reduced schedules of work, with the amount determined by the associate dean for academic programs (ordinarily no more than three courses each of the first two semesters), and also includes a review of work at the end of each semester by the Committee on Academic Standing until limited program status is lifted.

**Application Procedures for Master of Theological Studies Program.** Application forms can be secured from the admissions office and should be filed six to twelve months in advance of the intended date of enrollment. Ordinarily, no application for the M.T.S. degree will be accepted after 15 May and 1 November for August and January enrollments, respectively. The student should provide the following supporting documents and information: (1) one copy of the official transcript from each college, university, or seminary attended sent by the institution directly to the director of admissions; (2) one supplementary transcript, sent as soon as possible, showing completion of work which was in progress when the earlier transcript was made; (3) the names of three or four college (or seminary) professors who are best qualified to judge the applicant as a prospective student in the Divinity School and who will be contacted by the school for written letters of recommendation; and (4) the name of at least one person willing to serve as a general reference who will be contacted by the school for a written letter of recommendation. *Materials submitted in support of an application are not released for other purposes and cannot be returned to the applicant.*

**Admission Requirements.** Those persons are encouraged to apply for the M.T.S.:

1. who have been awarded a bachelor's degree from a regionally accredited college or university prior to their intended date of enrollment;
2. who have attained at least an overall B (3.0 on a 4.0 scale) academic average; and
3. who demonstrate program goals commensurate with this degree program.

**Application Procedures for Master of Theology Program.** Application forms can be secured from the admissions office and should be filed six to twelve months in advance of the intended date of enrollment. Ordinarily, no application for the Th.M. degree will be accepted after 15 May and 1 November for August and January enrollments, respectively. The student should provide the following supporting documents and information: (1) one copy of the official transcript from each college, university, or seminary attended sent directly to the director of admissions by the institution; (2) one supplementary transcript, sent as soon as possible, from the seminary showing completion of work which was in progress when the earlier transcript was made; (3) the names of three seminary professors who are best qualified to judge the applicant as a prospective student in the Divinity School and who will be contacted by the school for written letters of recommendation; (4) the name of one denominational official qualified to appraise the applicant's ministerial work who will be contacted by the school for a written letter of recommendation; and (5) scores from either the Graduate Record Examination or the Miller Analogies Test sent directly to the school. *Materials submitted in support of an application are not released for other purposes and cannot be returned to the applicant.*





**Admission Requirements.** Those persons are encouraged to apply for the Th.M.:

1. who have been awarded a bachelor's degree from a regionally accredited college or university;
2. who have or will have been awarded the M.Div. degree (or the equivalent) from an accredited theological institution;
3. who have achieved superior academic records; and
4. who desire to continue or resume their theological education for enhancement of professional competence in selected areas of study.

*Other than one scholarship per year for an international student, Master of Theology students are not eligible for any form of financial assistance through the Divinity School.*

**Additional Procedures for International Students.** Fully qualified students from outside the United States are welcome to apply for admission to the Divinity School. In applying for admission the international student must, in addition to the information required of all students, submit with the application material: (1) if the student's native language is not English, certification of English proficiency demonstrated by scores from the Test of English as a Foreign Language (TOEFL), administered through the Educational Testing Service in Princeton, New Jersey, (the Divinity School requires a score of 550 or higher on the TOEFL); (2) a statement of endorsement from an official of the student's national ecclesiastical body, affirming that ecclesiastical body's support for the student's pursuit of theological studies in the United States and welcoming the student into active ministry under its jurisdiction following the student's study in this country; and (3) a statement demonstrating financial arrangements for the proposed term at the Divinity School (estimated costs per calendar year are \$17,000\*). *An international student must submit scores from the TOEFL, a financial statement, an endorsement by an official of an ecclesiastical body, and have all transcripts and five letters of recommendation sent to the admissions office of the Divinity School before the Divinity School will make any offer of admission.*

**Admission as a Special Student.** Special student status is a restricted category of admission for persons who do not have need of a degree program and who desire access to the rich offerings of the Divinity School curriculum for particular purposes (courses are taken for credit). Special student status may be granted after a person has submitted an application and all transcripts of undergraduate academic work and when all three letters of recommendation have been received from listed references. Applications for special student status must be submitted at least forty-five days prior to the intended date of enrollment. *Special students are ineligible for any form of financial assistance through the Divinity School.*

**Admission Acceptance.** Applicants are expected to indicate their acceptance of admission within three weeks of notification and to confirm this with the payment of an admission fee of \$50. Upon matriculation, this fee is applied to the first semester tuition charge.

To complete admission students must provide a certificate of immunization and general health to the student health service. The admission office must also receive a final transcript verifying the conferral of the undergraduate (for the M.Div., M.T.S. and M.R.E.) or seminary (for the Th.M.) degree.

Persons who do not matriculate at the time for which they were originally admitted forfeit admission unless they present a written request for postponement to the director of admissions. The application will then be placed in the deferred file, active for one calendar year.

**Transfer of Credit.** Transfer of credit from theological schools accredited by the Association of Theological Schools is allowed by the Divinity School towards the Master of Divinity, Master of Religious Education, and Master of Theological Studies degrees. Credit

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\*Figures are based on 1988-89 charges and are subject to change.

from another institution will normally be limited in the M.Div and M.R.E. programs to one-third of the total number of credits required for graduation by the Divinity School (and to one-quarter for the M.T.S.). In each case a letter of honorable dismissal from the school from which transfer is made is required along with a transcript of academic credits. Applicants for transfer into a degree program are evaluated on the same basis as other applicants.

## **Conduct of Students**

Duke University expects and will require of all its students continuing loyal cooperation in developing and maintaining high standards of scholarship and conduct. The university wishes to emphasize its policy that all students are subject to the rules and regulations of the university currently in effect, or which are put into effect from time to time by the appropriate authorities of the university. Any student, in accepting admission, indicates willingness to subscribe to and be governed by these rules and regulations and acknowledges the right of the university to take such disciplinary action, including suspension and/or expulsion, as may be deemed appropriate, for failure to abide by such rules and regulations or for conduct adjudged unsatisfactory or detrimental to the university.

The Divinity School expects its students to participate in a communally shared concern for growth in life appropriate to Christian faith and to the dignity of their calling.

## **Readmission to Duke Divinity School**

Persons seeking readmission to the Divinity School's degree programs must complete the following requirements: (1) submit a new application; (2) submit an additional statement detailing reasons for withdrawal and reasons for seeking readmission at this time, and describing activities and employment undertaken since withdrawal; (3) submit the names of at least three persons willing to serve as references, one of which must be an ecclesiastical official; and (4) transcripts of all academic work undertaken since withdrawal from the Divinity School.

These new materials, supplemented by the individual's original application and Divinity School academic and field education files, will be reviewed by the members of the Admissions Committee for an admission decision. An interview with the director of admissions prior to the processing of the application for readmission is encouraged and may be required. Any questions about readmission procedures should be addressed to the director of admissions. Applications for readmission will be evaluated on the basis of academic attainment, future promise for the ministry, and vocational clarity and commitment.

*Community Life*



## Corporate Worship

One of the most important aspects of training for Christian life is vigorous, inspiring, and varied participation in corporate worship. This corporate life of the Divinity School is centered in York Chapel where three services are held weekly—a service of word and prayer on Tuesday, a service of preaching on Wednesday, and a service of word and table on Thursday. These services are led by members of the faculty, the student body, and guests. Services are voluntary but have been and will continue to be sources of inspiration and strength to the members of the community.

The Divinity School enjoys a particularly close relationship with Duke Chapel. Throughout the year, Divinity School administrators and faculty, as well as guests of national and international stature, preach at Sunday morning worship services. Each year many of our students join the 200-plus member Duke Chapel Choir which provides choral music on Sunday mornings and special music programs throughout the academic year, including an annual Christmas performance of Handel's *Messiah*. Divinity students and faculty also contribute to the leadership of the ministry of Duke Chapel by chairing and serving on standing committees: Faith and the Arts, Supportive Ministries, Worship, Prophetic Concerns, and Leadership and Development.

## Living Accommodations

**Town House Apartments.** Duke University operates Town House Apartments primarily for graduate and professional school students. Others may be housed if vacancies exist. The setting of these apartments provides single graduate students a comfortable, home-like atmosphere. Sixteen of the thirty-two air-conditioned apartments are equipped for two students, and the remaining sixteen units are equipped for three students.

**Central Campus Apartments.** Duke University operates a 500-unit housing facility known as Central Campus Apartments. The complex provides basic housing for undergraduate and single graduate students. One-bedroom and two-bedroom apartments are fully furnished. Assignments are made on a first-apply, first-assigned basis.

**Application Procedures.** When students are informed of their acceptance to the Divinity School, they will also receive a form on which to indicate their preference for university housing. This form should be returned to the Department of Housing Management.



Detailed information on the types of accommodations and application forms will be forwarded to the accepted student. However, if additional information is desired prior to a student's acceptance, please write to the Department of Housing Management, Duke University, Durham, North Carolina 27706.

**Off-Campus Housing.** The Department of Housing Management maintains lists of rental apartments, rooms, and houses provided by Durham property owners or real estate agents who will agree not to discriminate in the rental of property because of race, sex, creed, or nationality of a prospective tenant. These lists are available in the Central Campus office. Off-campus rental properties are not inspected or approved, nor does the university or its agents negotiate with owners for students, faculty, or staff. The majority of divinity students live in off-campus apartment complexes because of their proximity to the school and their competitive rental rates. A listing of such complexes can be secured from the Department of Housing Management of the university or from the Office of Admissions of the Divinity School.

**Food Services.** Food service facilities located throughout the Duke campus include both board plan and cash operations. Graduate and professional students are welcome to eat in any of the board plan cafeterias at guest meal prices or they may participate voluntarily in any of the point plans. Details are available from the Auxilliary Contract Office, 024 West Union Building. Board plans in the Blue and White Room Cafeteria and the East Court Cafeteria provide participants and their guests with unlimited seconds-style meals throughout the week at set prices. Dining facilities on the West Campus include a cafeteria with multiple-choice menus, the Oak Room with table service, and the Cambridge Inn with fast foods and beverages. The Bryan Center has a snack bar and a Rathskeller, both open all week, morning through late evening. East Campus has cafeteria service and a snack bar. Trent Drive Hall has a public cafeteria and North Central Connection, a snack bar/delicatessen. Duke University Food Services is the largest student employer on campus, and hires students in almost every food operation. A listing of open positions and areas is available from the Personnel Office, B3 East Union Building, or Student Labor Services Office, 03 West Union.

## Student Health

**Student Health Program.** The aim of the university health program is to provide medical care and health advice necessary to help the student enjoy the university community. To serve this purpose, both the university health service clinic and the university infirmary are available for student health care needs. A mandatory student health fee for these services is assessed for all full-time and part-time degree candidates (special students, auditors, and student pastors are exempt). Appeal for waiver can be made to the university's dean of student life during registration for classes.

The main components of the health service include the university health service clinic, located in the Pickens Building on West Campus, and the university infirmary in Duke Hospital South. Emergency transportation, if required, can be obtained from the Duke campus police. Residential staff personnel or Divinity School administrators should be consulted whenever possible for assistance in obtaining emergency treatment.

The facilities of the university health service clinic are available during both regular and summer sessions to all currently enrolled full-time students. The facilities of the university infirmary are available during the regular sessions from the opening of the university in the fall until graduation day in the spring to all currently enrolled full-time students.

**Student Insurance Program.** The university has also made arrangements for a Student Accident and Sickness Insurance plan to complement the coverage provided by the Student Health Program. All full-time and part-time degree candidates are required to be financially responsible for medical expenses above those covered by the Student Health

Program, either through this university insurance policy, a private policy, or personal financial resources. Students who have equivalent medical insurance or wish to accept the financial responsibility for any medical expense may elect not to take the Duke insurance plan by completing the waiver statement contained on the remittance form of the university invoice. This statement requires the name of the insurance company and the policy number as well as the signature of the student or parent. Also, this requirement may be waived by signing the appropriate space on the university invoice indicating willingness to assume the medical costs of any sickness or accident.

For additional fees, a student may obtain insurance coverage for a spouse or spouse and children. Married students are expected to be financially responsible for their dependents, providing for hospital, medical, and surgical care, since their dependents are not covered at any time by the Student Health Program.

The resources of the Duke University Medical Center are available to all Duke students and their spouses and children. Charges for any and all services received from the Medical Center are the responsibility of the student as are the charges for services received from physicians and hospitals not associated with Duke University.

**Counseling and Psychological Services.** Counseling and Psychological Services (CAPS) is a component of student services which provides a coordinated, comprehensive range of counseling and developmental services to assist and promote the personal growth of Duke students. The professional staff is composed of psychologists, clinical social workers, and psychiatrists experienced in working with students of all ages. They provide evaluation and brief counseling/psychotherapy regarding a wide range of concerns, including such issues as self-esteem and identity, family relationships, academic performance, dating, intimacy, and sexual concerns. While students' visits with counselors are usually by appointment, a walk-in consultation service is provided two hours each weekday for students with urgent personal concerns.

Each year CAPS offers a series of seminars focusing on skills development and special interests. These explore such interests as stress management, assertiveness training, career planning, couples' communication, and study skills. Interested students may call or come by CAPS for further information.

As Duke's center for administration of national testing programs, CAPS also offers a wide variety of graduate/professional school admission tests and professional licensure and certification examinations. The staff is also available to the entire university community for consultation and educational activities in student development and mental health issues affecting not only individual students but the campus community as a whole. They work with campus personnel, including administrators, faculty, student health staff, religious life staff, resident advisers, and student groups, in meeting needs identified through such liaisons. Staff members are available to lead workshops and discussion groups on topics of interest to students.

CAPS maintains a policy of *strict confidentiality* concerning information about each student's contact with the CAPS staff. If a student desires that information be released to anyone, written authorization must be given by the student for such release.

There are no charges for initial evaluation, brief counseling/psychotherapy, or self-development seminars. If appropriate, referral may be made to other staff members or a wide variety of local resources.

Appointments may be made by calling 684-5100 or coming by the office in 214 Old Chemistry Building, West Campus, between 8:00 A.M. and 5:00 P.M. Monday through Friday. If a student's concern needs immediate attention, that should be made known to the secretary, and every effort will be made to arrange for the student to talk with a staff member at the earliest possible time.

## Motor Vehicles

Each student possessing or maintaining a motor vehicle at Duke University must register it at the beginning of the academic year. If a motor vehicle is acquired and maintained at Duke University after academic registration, it must be registered within five calendar days after operation on the campuses begins. Resident students are required to pay an annual fee of \$50 for each motor vehicle or \$25 for each two-wheeled motor vehicle. Students first registering after 1 January are required to pay \$30 for a motor vehicle or \$15 for a two-wheeled motor vehicle.

At the time of registration of a motor vehicle, the following documents must be presented: the state vehicle registration certificate, a valid driver's license, and satisfactory evidence of automobile liability insurance coverage with limits of at least \$10,000 per person and \$20,000 per accident for personal injuries, and \$5,000 for property damage, as required by the North Carolina motor vehicle law.

If a motor vehicle or a two-wheeled motor vehicle is removed from the campus permanently and the decal is returned to the traffic office prior to 20 January there will be a refund of one-half of the fee paid for either a motor vehicle or a two-wheeled motor vehicle.

## Student Activities and Organizations

In the absence of common living and dining accommodations, community life in the Divinity School centers around a number of organizations and activities. The richness of life prevents more than a very selective listing of activities and organizations.

A primary center for community is a morning chapel service held every Tuesday, Wednesday, and Thursday in York Chapel while school is in session. Faculty and students share joint responsibility for these services which attempt to express the variety and diversity of theological and liturgical perspectives represented in the membership of the community. These chapel services are followed by a fellowship hour in the Student Lounge where hot beverages and pastries are served to a group that on most days includes students, faculty, administrators, support staff, student spouses and children, and visitors.

In addition to overseeing the planning of the regular morning chapel services, the student-faculty Worship Committee develops a number of occasional worship experiences throughout the academic year in keeping with the liturgical calendar and church festivals. Special interest groups growing out of and related to the Worship Committee include such sub-committees as Sacred Movement and Dance, Worship and the Arts, and Liturgical Environment. Still other worship opportunities are available through Duke Chapel where midday and evening prayer services on weekdays during the school year, weekly Sunday worship, Eucharist, and festival services are held.

Several informal groups exist whose major purpose is to provide students with opportunities to express and share personal, professional, and spiritual development with each other in weekly meetings on the campus and at home. Among these are covenant discipleship, prayer and contemplation, and lectionary discussion groups.

**Black Seminarians' Union.** This is an organization of black students whose major purposes are to insure the development of a theological perspective commensurate with the Gospel of Jesus Christ and relevant to the needs of black seminarians and the black church and to improve the quality of life academically, spiritually, politically, and socially in the Divinity School.

**Christian Educators Fellowship.** As a professional organization for persons who serve or intend to serve as professional Christian educators, CEF interprets the role of the Christian educator in the total ministry of the Church and provides support, fellowship, and professional relationships. In addition to monthly program meetings, a Christian education emphasis week is held each spring.







**Divinity School Choir.** A student organization of long standing is the Divinity School Choir. Membership is open to all qualified students. The choir sings regularly for week-day worship and at special seasonal programs and services. New members are chosen by informal auditions which are arranged for all who are interested.

**Divinity Spouses.** Divinity Spouses is an organization which offers the spouses of regularly enrolled students opportunities for sharing interests and concerns. The spouses' program, which includes topical monthly meetings with a variety of speakers, small interest groups, and special projects, seeks to encourage and provide ways for spouses to become a more integral part of the Divinity School community. Monthly meetings are open to all persons. A favorite event each year is a progressive dinner for couples involving the visitation of a number of faculty homes.

**Episcopal Students Fellowships.** Recognizing a need for denominational support, fellowship, and worship life, Episcopal students organized the Episcopal Students Fellowship in the spring of 1988. In addition to informal gatherings and group meals, the organization worships together three times a week: Eucharist on Tuesday mornings, Morning Prayer on Wednesday mornings, and Evening Prayer on Thursday afternoons.

**Order of St. Luke.** Formed to bring about a recovery of the worship and sacramental practice which has sustained the Church since its formation in apostolic times, the Order of St. Luke is a religious order within the United Methodist Church that additionally is concerned to help recover the spiritual disciplines of John and Charles Wesley as a means of perceiving and fulfilling the mission for which the Church was formed. Membership in the Order is open to lay persons, seminarians, clergy of the United Methodist Church, and to persons of other denominations. The Divinity School chapter of the Order of St. Luke was chartered in the fall of 1987.

**Spiritual Formation Groups.** While students advance in the area of academics, they have a corresponding need to attend to their spiritual development. Within the community there are several student-initiated small groups which help meet those needs. Students, faculty, and staff are all invited to participate. Among these are Covenant Discipleship, Prayer and Contemplation, Care and Share, Walk to Emmaus Reunion, and lectionary discussion groups.

**Student Pastors' Association.** Students actively serving their denominations in an ordained or lay capacity have the opportunity to meet, to share, to plan, and to act on their common needs and concerns.

**The Student Association.** The officers of the Student Association are elected and serve as an executive committee for conduct of the business of the Representative Assembly.

The purpose of the association is to channel the interests and concerns of Divinity School students to the following ends:

1. to provide student programs and activities
2. to represent students to the faculty and administration
3. to represent students with other Duke University organizations; and
4. to represent students in extra-university affairs.

The Community Life Committee of the Student Representative Assembly annually plans at least twelve community-wide events for students and faculty. Weekend retreats present students with an opportunity to become better acquainted with each other and with faculty, and to explore matters of personal, professional, or spiritual concern. Dialogues on ministry occurring through the year help introduce students to practicing ministers and their personal, professional, and spiritual struggles and growth.

The Christian Social Action Committee of the Student Representative Assembly serves as a forum through which persons explore what it means to live out the gospel in

a social context as witnesses of Christ. As an organization that prays for the support of the community and for guidance concerning social issues and also seeks to create awareness so that our vision of God's will in society is enlarged, CSA meets on a weekly basis; hosts forums on topics such as capital punishment, sexuality and the Church, and peace with justice; provides leadership for events such as the annual Crop Walk and Red Cross blood drives; and coordinates the matching of volunteers with church and community agencies.

**Women's Center.** The Women's Center serves the entire Divinity School community through a focus on the special needs and contributions of women in ministry in and to the Church and society. The office, coordinated by two women, is a resource center for the whole community, in addition to a support and action center for women in particular.

## Cultural Resources

Divinity School students enjoy access to the many resources of the university community, particularly in the area of the performing arts. Two active campus film societies sponsor screenings of major motion pictures on Saturday and Sunday evenings. Other films of a classical nature are offered on Tuesday through Thursday nights, with occasional free films for children. Opportunities in music, dance, and drama are provided by the following: the Duke Artists Series, Broadway at Duke, the Chamber Arts Society, Hoof 'n Horn, the Duke University Collegium Musicum, Duke Players, Duke Dance, the Duke University Symphony Orchestra and the Wind Symphony, the Duke University Jazz Ensemble, the Ciompi Quartet, Dance Black, and the Modern Black Mass Choir, among others.

## Athletic Programs

In addition to unrestricted access to all university athletic and recreational facilities, divinity students enjoy other benefits from Duke's commitment to college athletics. The university is a member of the Atlantic Coast Conference of the National College Athletic Association, and offers intercollegiate competition in a variety of sports. Special admission rates to football and basketball games are available to graduate and professional students. The university supports a strong intramural program in which the Divinity School participates enthusiastically. In recent seasons the school has fielded teams in football, men's, women's, and co-rec basketball, volleyball, soccer, and softball.

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*Financial Information*



## Fees and Expenses

**Master of Divinity, Master of Theological Studies, and Master of Religious Education Candidates.** The table below lists basic minimum expenditures. In addition to the fees cited here, there is an admission fee of \$50 which is applied to the first term bill. See relevant section on admissions for details.

	<i>Per Semester</i>	<i>Per Year</i>
Tuition-M.Div., M.T.S., and M.R.E.	\$2,940	\$5,880
Student Health Fee	150	300
Approximate Cost of Meals	1,100	2,200
Student Representation Association Fee	10	20

Tuition will be charged at the rate of \$735 per course. The figures shown are for a program carrying eight courses per year. Students will be charged for additional course enrollments.

**Master of Theology Candidates.** A student who is a candidate for the Th.M. degree will be liable for tuition on the basis of eight courses at the rate of \$735 per course. All other costs and regulations for the Th.M. degree are the same as those for the M.Div. degree. Th.M. students are not ordinarily eligible for student financial aid.

**Special Student.** A special student is one who is enrolled for academic credit, but who is not a candidate for a degree at that time. The tuition will be charged on a course basis. Other costs and regulations are the same as those for M.Div. candidates. No financial aid is available.

**Audit Fee.** Anyone seeking to audit a course in the Divinity School must, with the consent of the instructor concerned, secure permission from the associate dean's office. In accordance with the general university practice, a fee of \$100 per course will be charged to all auditors who are not enrolled as full-time students.

**Estimated Living Expenses.** The total cost for a student to attend the Duke Divinity School varies according to individual tastes and requirements; however, experience indicates that a single student may expect to spend a minimum of \$14,300 for nine months and a married couple may expect to spend a minimum of \$19,500 for twelve months.

**Housing Fees.** Estimated minimal on-campus housing cost for a single student will be approximately \$3,000 during 1988-89. Presently the university does not provide housing



for married students. Housing fees are subject to change prior to the new academic year. A \$100 deposit is required on all reservations.

Rates for Central Campus Apartments will be quoted to applying students upon request to the manager of apartments and property. Refunds on housing fees will be made in accordance with the established schedules of the university.

**Athletic Fee.** Divinity School students may secure admission to all regularly scheduled university athletic contests held on the university grounds during the entire academic year by payment of the athletic fee of \$100 per year plus any federal tax that may be imposed. The fee is payable in the fall semester.

**Payment and Penalty.** Invoices for tuition, fees, and other charges will be sent by the bursar's office which are payable by the invoice due date; no deferred payment plans are available. As a part of the agreement of admission to Duke university a student is required to pay all invoices as presented. If full payment is not received, a late payment charge as described below will be assessed on the next invoice and also certain restrictions as stated below will be applied.

If payment in the amount of the total amount due on the student invoice is not received by the invoice due date, a penalty charge will be accrued from the billing date of the invoice. The penalty charge will be at a rate of 1½ percent per month (16 percent per annum) applied to the past due balance on the student invoice. The past due balance is defined as the previous balance less any payments and credits received during the current month and also any student loan memo credits, related to the previous balance, which appear on the invoice.

An individual will be in default of this agreement if the total amount due on the student invoice is not paid in full by the invoice due date. An individual who is in default will not be allowed to register for classes, receive a transcript of academic records, have academic credits certified, be granted a leave of absence, or receive a diploma at graduation. In addition, an individual in default may be subject to withdrawal from school.

Refunds of tuition and fees are governed by the following policy:

In the event of death a full tuition and fees refund will be granted.

In all other cases of withdrawal from school tuition will be refunded according to the following schedule: withdrawal before the opening of classes—a full refund; withdrawal during the first or second week—80 percent; withdrawal during the third through fifth week—60 percent; withdrawal during the sixth week—20 percent; withdrawal after the sixth week—no refund. *No refund will be granted for reduction in course load after drop-add period.*

Tuition or other charges paid from grants or loans will be restored to those funds on the same prorata basis and will be refunded to the student or carried forward.

These regulations apply to all Divinity School students—degree candidates, special students, and auditors.

**Debts.** No records are released, and no students are considered by the faculty as candidates for graduation, until they have settled with the bursar for all indebtedness. Bills may be sent to parents or guardians provided the bursar has been requested in writing to do so. Failure to pay all university charges on or before the times specified by the university for the semester will bar the student from class attendance until the account is settled in full.

**Motor Vehicle Registration Fee.** There is a \$50 registration fee for all automobiles (\$20 for two-wheeled motor vehicles) used on campus. Students who register their automobile will not be charged for registration of a motorcycle. For specifics see the chapter "Community Life."

## Student Financial Aid

A student should select a school on the basis of educational opportunity. At the same time financial consideration will be a legitimate and often pressing concern. Each student should formulate at least a tentative plan for financing the entire seminary education. Although the exact method of financing the full theological degree may not be assured at the beginning, a student should have a clear understanding of the expenses and available sources of income for the first year and the assurance that there exist ways of financing subsequent years.

The Committee on Financial Aid will counsel the student concerning financial needs and possible resources. There is constant review of available resources in order to assist the greatest number of students. However, the basic financial responsibility belongs to the student, who is expected to rely upon personal and family resources, earnings, and borrowing power. Other resources may include the student's church, civic groups, foundations, and resources of the school (grants, loans, field education grants, and employment). It is the goal of the financial aid office to assist each student in planning a financial program so that as little indebtedness as possible will be incurred.

The total amount available through the Divinity School is limited. Further, the conditions set forth by the individual or institutional donors determine the circumstances under which the grants can be made. *Almost without exception the donors require ecclesiastical endorsement and/or declaration of ministerial vocational aim.*

The principles regarding the disbursement of financial aid are as follows:

1. Financial aid is recommended on the basis of demonstrated need. All students must file an application which substantiates need and provides full information on potential resources. This is essential in order to make Divinity School funds available to the greatest number of students. In order to receive assistance in any form from the Divinity School, a student must be enrolled for at least three courses per semester and maintain an overall academic average of 2.0 or higher. Falsification of a financial aid application is a serious offense subject to the provisions of the Divinity School's Judicial Procedures.
2. Grants will be made within the limits of the conditions set forth governing each source.
3. The conditions at the beginning of the academic year determining financial needs shall be the governing criteria for the year. Financial aid programs are set up on a yearly basis, except for those students who may enter the second semester and/or those few whose status may change.
4. Financial aid grants are made on a one-year basis. The assistance may consist of scholarships, loans, tuition grants, grants-in-aid, field education grants, and employment, which may be worked out in various combinations on a yearly basis. A new application must be filed each year.
5. Grants-in-aid, or "tuition grants," are ballooned for the first year of study to assist students as much as possible through their transitional first year at Duke. *Consequently grants for the second and third years of study will be less than those awarded for the critical first year.*
6. Application for financial aid may be made by entering students at time of admission or currently enrolled students by December 1. Notification will be given after committee approval. Student pastors serving United Methodist churches can be notified after the pastoral charge and Annual Conference determine salary schedules. Financial aid applications for students anticipating fall matriculation are reviewed beginning the prior December. Applications for assistance will not be accepted after June 1 for August enrollment or after December 15 for January enrollment.
7. Ordinarily financial aid is not available beyond six semesters (eight for pastors on reduced load).

8. Full-time students not participating in the field education program may work up to twenty hours per week in outside employment. Persons participating in the field education program, either summer or winter, may not engage in other forms of employment.
9. Students who have questions about the Divinity School's response to their financial aid request should first speak with the financial aid assistant. Where desired, students may file an appeals form for full review by the financial aid appeals committee.
10. Financial aid resources for M.T.S. students are limited. Candidates are encouraged to apply early.
11. Special students and Th.M. students (with the exception of one international scholar annually) are not eligible for any form of financial assistance from the Divinity School. Th.M. students are eligible to apply for denominational and federal loans.

## Financial Resources

**Personal.** In order that both the Church and the Divinity School may be able to extend the use of their limited funds to as many students as possible, a student who desires a theological education should be willing to defray as far as possible the cost of such an education. Resources may include savings, earnings, gifts, support or loans, and if married, earnings of a spouse. In calculating anticipated income, the student first considers personal resources.

**Church.** Many local churches and conferences or other governing bodies provide gifts and grants for theological education, such as ministerial education funds which provide grants and/or service loans to theological students. The student makes application to the home church, Annual Conference, Presbytery, or other governing body. The financial aid office cooperates with these church agencies in making recommendations and in handling the funds. *United Methodist students and others must be under the care of the appropriate church body to be eligible for church support.* The school cannot compensate for a student's indisposition to receive church funds when such are available on application through the Annual Conference Ministerial Education Fund or other agencies.

The Divinity School, as a member school of the Association of United Methodist Theological Schools, takes cognizance of and subscribes to recommended policy and practice regarding the administration of United Methodist Church funds for student financial aid as adopted by the association, 1 June 1970, and as bearing upon tuition grants, as follows:

Resources for tuition grants, scholarships, or the like are primarily available to students with declared vocational aims leading to ordination or recognized lay ministries and supported by commendation or endorsement of appropriate church representatives. At the same time, we believe that consideration for a tuition grant may be accorded to students who adequately indicate conscientious concern to explore, through seminary studies, a recognized church-related vocation. Finally, it is our judgment that, where the above-mentioned conditions are deemed to be absent respecting a candidate for admission, the decision to admit such a candidate should be without the assurance of any tuition subsidy deriving from church funds. (*AUMTS Minutes*, 1 June 1970.)

**Divinity School Scholarships.** A limited number of scholarships are available to encourage qualified students to pursue their preparation for the Christian ministry.

**Duke Scholars Grant.** Each year the Divinity School awards a maximum of ten scholarships to entering junior students on the basis of academic excellence in their undergraduate programs and promise for Christian ministry. The specific amount of a scholarship for academic merit will depend upon a student's demonstrated financial need and will not exceed a maximum \$4,500.

Up to ten scholarships for academic achievement are given for the middler and senior years of study. These awards go to those students with the greatest promise of service to the Church and highest academic achievement. The scholarship ranges up to \$4,500 in value, depending upon the recipient's *demonstrated* financial need, and academic course load.



*Distinguished Service Scholarship.* Each year the Divinity School offers a maximum of ten scholarships ranging up to \$4,500 in value to those students who combine excellence in academic achievement with outstanding promise for ministry in the local church. These scholarships are renewable in the second and third years if the student continues to exhibit (1) exceptional academic achievement with a grade point average of 3.35 or higher, and (2) vocational promise as reflected in participation in field education and the Divinity School community.

*The Dean's Scholarship.* The dean's scholarships are awarded to eligible recipients each year. These persons must represent strong promise for Christian ministry, academic achievement, and demonstrated financial need. Factors taken into account are ethnic origin, missional responsibilities for the Church at home and abroad, and special denominational needs. The specific amount of the scholarship is based upon demonstrated need and may go up to \$4,000 per year. The scholarship is renewable for two years assuming continued academic achievement, development of ministerial promise, and demonstrated financial need.

*International Student Scholarships.* In cooperation with the Crusade Scholarship Committee of the United Methodist Church and other authorized church agencies, students are selected and admitted to courses of study. Scholarships for such students are provided from the Lewis Clarence Kerner Scholarship Fund and from individual churches and private philanthropy.

**Tuition Grants.** These are available in amounts commensurate with demonstrated need as adjudged by the Committee on Financial Aid. Entering students may apply, on notice of admission, by submitting the financial aid application to the Office of Financial Aid. Enrolled students may apply for annual renewal. Because of the purpose and attendant educational objectives of the school, resources for tuition grants are primarily available to students with declared aims leading to ordination or recognized lay ministries.

**Field Education Grants.** Varying amounts ranging from \$2,400 (winter) to a maximum of \$5,100 (summer) are made available through the Divinity School to students who are approved to participate in the field education program. The Offices of Field Education and Financial Aid work together in determining placement and grant amount. This program includes the summer interns, winter interns, and student pastors. See full description under the section on field education.

**Duke Endowment Student Pastor Grants.** United Methodist students serving under episcopal appointment as student pastors in the state of North Carolina may qualify for tuition assistance of no more than \$2,400 through the Duke Endowment. The Financial Aid Committee will determine student eligibility for such assistance after appointments are read at the meetings of the two North Carolina United Methodist Annual Conferences.

**Loans.** Loan funds held in trust by the university, as well as United Methodist student loans and funds supplied by the federal government through the National Defense Education Act of 1958 are available to qualified students. The application must be submitted by 1 July.

Unless otherwise indicated, all correspondence concerning financial aid should be directed to: Financial Aid Office, The Divinity School, Duke University, Durham, North Carolina 27706.

**Employment.** Students or spouses desiring employment with the university should apply to the director of personnel, Duke University. Students or spouses make their own arrangements for employment either in the city of Durham or on campus.

## Endowed Funds

Certain special funds have been established as endowments, the income from which is used to provide financial aid through scholarships and field education grants for stu-



dents, support for professorships, and enhancement of the Divinity School program. The funds listed below serve as essential resources for the preparation of persons for leadership in Christian ministry.

**The Alumni Scholarship Fund** was established in 1976 by the graduates of the Divinity School to provide financial support for ministerial candidates.

**The Martha Anne Hills Andrews and John Spell Andrews Scholarship Fund** was established in 1985 by Don W. Andrews in memory of his wife, Martha Anne, Divinity School Class of 1982, and their son, John. The fund income provides student scholarships with preference given to women and men from South Carolina.

**The R. Ernest Atkinson Legacy** was established in 1952 under the will of the Reverend R. Ernest Atkinson, Trinity College Class of 1917, Richmond, Virginia, for ministerial student assistance.

**The Hargrove, Sr., and Kelly Bess Moneyhun Bowles Fund** was established in 1983 by John Bowles, Hargrove Bowles, Jr., R. Kelly Bowles, and James Bowles in memory of their parents. Income from the fund is for scholarship assistance in the Divinity School.

**The Fred W. Bradshaw Fund** was established in 1975 through a bequest from Fred W. Bradshaw of Charlotte, North Carolina, to be utilized for the enrichment of the educational program of the Divinity School, especially to support distinguished visiting scholars and outstanding students.

**The Emma McAfee Cannon Scholarship** was established in 1969 by Bishop William R. Cannon in memory of his mother, Emma McAfee Cannon, and is designated to assist students from the North Carolina Annual Conference of the United Methodist Church who are studying for the pastoral ministry and planning to serve in the North Carolina Conference.

**The Clark Fund for Emergency Assistance** was established in 1986 by Mrs. Kenneth W. Clark as a discretionary aid resource to help meet the needs of students who experience unforeseen crises due to serious illness, injury, or family emergencies.

**The Kenneth Willis Clark Lectureship Fund** was established in 1984 by Mrs. Adelaide Dickinson Clark in memory of her husband, Kenneth W. Clark, professor of New Testament in the Divinity School, 1931-67. The fund provides for distinguished lectureships in New Testament studies and textual criticism.

**The James T. Cleland Endowment Fund** was established by friends and students of James T. Cleland to create a Chair of Preaching in his honor. He was dean of the Duke University Chapel from 1955 to 1973 and professor of preaching in the Divinity School.

**The E. M. Cole Fund** was established in 1920 by Eugene M. Cole, a United Methodist layman of Charlotte, North Carolina, to support the education of ministers.

**The Lela H. Coltrane Scholarship** was established in 1980 by Mrs. David S. Coltrane of Raleigh, North Carolina, and friends of Mrs. Coltrane, to encourage excellence in ministry.

**The Robert Earl Cushman Endowment Fund** was established in 1980 to create a professorship in honor of Robert Earl Cushman, research professor of systematic theology and dean of the Divinity School, 1958-71.

**The Dickson Foundation Awards** were established by the Dickson Foundation of Mount Holly, North Carolina, to provide assistance to students who demonstrate financial need and superior ability.

**The Duke Endowment**, established in 1924, provides under the Maintenance and Operation Program, field education grants for students of the Divinity School who serve in rural United Methodist churches under the Endowment and Field Education Program.

**The Henry C. Duncan Fund** was established in 1982 by the men of the Village Chapel, Pinehurst, North Carolina, to honor their pastor, Chaplain Henry C. Duncan, a member of the Divinity School Class of 1949. Income from the fund is used for scholarships.

**The N. Edward Edgerton Fund** was established in 1939 by N. Edward Edgerton, Trinity College Class of 1921, of Raleigh, North Carolina, for the support of ministerial education.

**The Will Ervin Scholarship Fund** is an endowment established by Will Ervin in 1980 and administered by the Richlands United Methodist Church, Richlands, North Carolina, for students preparing for Christian ministry.

**The Randolph R. and Shirley D. Few Scholarship Endowment Fund** was established in 1987 by Mr. and Mrs. Few of Durham, North Carolina, to provide assistance for ministerial students from the North Carolina Conference of the United Methodist Church.

**The George D. Finch Scholarship Fund** was established in 1972 by George David Finch, Trinity College Class of 1924, of Thomasville, North Carolina, for the support of ministerial education.

**The Edgar B. Fisher Memorial Scholarship Endowment Fund** was established in 1987 by the family of Dr. Fisher to commemorate his life of distinguished service in ministry and to provide assistance for men and women preparing to be United Methodist pastors in North Carolina.

**The W. Kenneth and Martha O. Goodson Fund** was established in 1981 to honor Bishop Goodson, Divinity School Class of 1937 and retired Bishop of the United Methodist Church, and Mrs. Goodson. The fund was doubled in 1985 by a major gift for scholarships and parish ministry support from Bishop and Mrs. Goodson.

**The James A. Gray Fund** was presented to the Divinity School in 1947 by James A. Gray of Winston-Salem, North Carolina, for use in expanding and maintaining its educational services.

**The Ned and Carmen Hagggar Scholarship Fund** was established in 1985 by Carmen Hagggar of Pinehurst, North Carolina, through her son, Alexander J. Hagggar, to support theological education at Duke.

**The P. Huber Hanes Scholarship** was established by the late P. Huber Hanes of Winston-Salem, North Carolina, Trinity College Class of 1900, as a scholarship fund for Duke University, a portion of which is used to provide financial assistance for Divinity School students.

**The Richard R. Hanner, Jr. Scholarship** was established in 1973 by friends of the late Richard R. Hanner, Jr., Trinity College Class of 1953, to support advanced work in Christian education.

**The Russell S. and Julia G. Harrison Scholarship Fund** was established in 1980 by Russell S. Harrison, Divinity School Class of 1934, and his wife, Julia G. Harrison. The fund supports persons from the North Carolina Conference of the United Methodist Church preparing for ordained ministry as local church pastors.

**The Harvey Fund** was established in 1982 by C. Felix Harvey and Margaret Blount Harvey, Trinity College Class of 1943, of Kinston, North Carolina, to provide scholarship assistance for students preparing for parish ministry.

**The H. E. S. Inc. Scholarship** is a grant from the H.E.S., Inc., Los Angeles, California, founded in 1931 by Dr. A. U. Michelson, which provides two full-tuition scholarships each year.

**The Stuart C. Henry Scholarship Fund** was established in 1986 by Mr. and Mrs. A. Morris Williams, Jr., of Gladwyne, Pennsylvania, to honor the distinguished teaching career of Professor Henry and to provide assistance for students with preference given to those affiliated with the Presbyterian Church.

**The Franklin Simpson Hickman Memorial Fund** was established in 1966 by Mrs. Veva Castell Hickman in memory of her husband, Franklin S. Hickman, who served as professor of the psychology of religion, the dean of the Chapel of Duke University, and the first preacher to the university. The fund income supports a regular visiting lecturer in preaching and provides financial aid to students who wish to specialize in the psychology of religion.

**The George M. Ivey Scholarship Fund** was established in 1948 by a gift of George M. Ivey, Trinity College Class of 1920, of Charlotte, North Carolina, for the support of ministerial education.

**The George Washington Ivey Professorship**, with initial funding by the Western North Carolina Conference of the United Methodist Church and later funding by George M. Ivey, George M. Ivey, Jr., Leon Ivey, and the Ivey Trust, is the oldest named professorship in the Divinity School.

**The Jameson Jones Memorial Fund** was established in 1982 by a bequest and memorial gifts following the untimely death of Jameson Jones, dean of the Divinity School, 1981-82. The fund provides for the enrichment of programs and study opportunities.

**The Charles E. Jordan Scholarship Fund** was established in 1969 by the family of Charles E. Jordan, former vice-president of Duke University, to support the education of ministers.

**The Amos Ragan Kearns Professorship** was established in 1970 by a gift from the late Amos Ragan Kearns of High Point, North Carolina, for a Chair in Religion.

**The Lewis Clarence Kerner Scholarship** was established in 1959 by Beatrice Kerner Reavis of Henderson, North Carolina, in memory of her brother and designated for the assistance of native or foreign-born students preparing for service in world Christian mission.

**The Carl H. and Mary E. King Memorial Fund** was established in 1976 by family and friends of Carl and Mary King, distinguished church leaders in Western North Carolina Methodism, to support students preparing for educational ministry in the parish.

**The John Haden Lane Memorial Scholarship** was established in 1968 by the family of John H. Lane to provide support for education in Christian ministry including chaplaincy and other specialized work.

**The Louie Mae Hughes Langford Scholarship Endowment Fund** was established in 1988 by Dr. and Mrs. Thomas A. Langford in memory of his mother.

**The Thomas A. and Ann Marie Langford Fund** was established in 1981 in honor of Dr. Thomas A. Langford, dean of the Divinity School, 1971-81, and Mrs. Langford.

**The Laurinburg Christian Education Fund** was established in 1948 by members of the First United Methodist Church, Laurinburg, North Carolina, for ministerial education.

**The John Joseph Lewis Fund** was established in 1982 by Colonel Marion S. Lewis, Trinity College Class of 1916, of Charleston, South Carolina, to honor his father, a circuit riding Methodist preacher. The fund income provides scholarship support.



**The D. M. Litaker Scholarship** was originally established by Charles H. Litaker in 1946 in honor of his father, Dr. D. M. Litaker, Trinity College Class of 1890, and was specified for the Divinity School in 1977 by the Litaker family. The income is for support of persons preparing for ministry in the Western North Carolina Annual Conference of the United Methodist Church.

**The Calvin M. Little Scholarship Fund** was established in 1985 by the members of the First United Methodist Church, Mt. Gilead, North Carolina, to commemorate a generous bequest from Mr. Little and to affirm the important relationships between the church and the Divinity School.

**The Robert B. and Mary Alice Massey Endowment Fund** was established in 1980 by Mr. and Mrs. Massey of Jacksonville, Florida, for the support of excellence in ministry.

**The Robert McCormack Scholarship** was established by the Trustees of the Duke Endowment to honor Robert McCormack, chairman of the board of the Duke Endowment at the time of his death in 1982.

**The J. H. McCracken Memorial Scholarship Fund** was established in 1947 by Dr. J. H. McCracken, Jr., of Durham, North Carolina, in memory of his father, the Reverend Jacob Holt McCracken, a Methodist minister who served churches in North Carolina for fifty years.

**The C. Graham and Gradie Ellen E. Mitchum Fund** was established in 1985 by Dr. and Mrs. Kenneth E. Mitchum of Pittsboro, North Carolina, in memory of his father, a lay preacher, and in honor of his mother. The fund provides scholarships for students who have significant financial needs and a strong commitment for ministry in the local church.

**The J. Alex and Vivian G. Mull Scholarship Endowment Fund** was established in 1987 by the grant committee of the Mull Foundation of Morganton, North Carolina, as a memorial to Mr. and Mrs. J. Alex Mull who were leaders in education, business, and the church. Priority is given to students from Burke County, North Carolina.

**The Myers Park Scholarship Fund** was established in 1948 by members of the Myers Park United Methodist Church, Charlotte, North Carolina, for ministerial education.

**The Needham-Hauser Scholarship Endowment Fund** was established in 1986 by Eugene W. Needham and his wife, Antoinette Hauser Needham, both Duke University graduates, of Pfafftown, North Carolina, to provide assistance for students committed to the parish ministry. Preference is given to persons from the Western North Carolina Conference of the United Methodist Church.

**The W. Fletcher Nelson Scholarship** was established in 1980 by friends of W. Fletcher Nelson, Duke Divinity School Class of 1930, of Morganton, North Carolina. He was responsible for the fund-raising efforts which enabled renovations and the building of the new wing of the Divinity School.

**The W. R. Odell Scholarship** was established in 1946 by the Forest Hills United Methodist Church, Concord, North Carolina, to honor Mr. Odell, a distinguished layman.

**The Parish Ministry Fund** was established in 1968 to provide continuing education opportunities for selected parish ministers and lay leaders from the Western North Carolina Conference of the United Methodist Church. The fund sponsors seminars, short study courses, and makes special grants for full-time study leaves. The program is administered by the Divinity School with the assistance of the Parish Ministry Fund's Board of Directors.

**The Emma Leah Watson and George W. Perrett Scholarship** was established in 1984 by Mrs. Perrett of Greensboro, North Carolina, to provide scholarships for students preparing for the ministry in the local church.

**The Cornelius Miller and Emma Watts Pickens Memorial Fund** was initiated in 1966 by the Pickens brothers to honor their parents. The fund income helps to support the Divinity School Media Center.

**The Maude Simpson Pitts Scholarship Endowment Fund** was established in 1986 by Mr. and Mrs. Noah O. Pitts, Jr., of Morganton, North Carolina, in memory of his mother. The fund provides support for students who are committed to parish ministry.

**The William Kellon Quick Endowment for Studies in Methodism and the Wesleyan Tradition** was established in 1985 by Mr. and Mrs. Stanley S. Kresge of Pontiac, Michigan, to support teaching, research, and publication in Methodist studies and to honor their pastor, William K. Quick, Divinity School Class of 1958.

**The Gilbert T. Rowe Memorial Scholarship Fund** was established in 1960 through the generosity of alumni and friends of the Divinity School to honor the memory of Dr. Rowe, professor of systematic theology.

**The Elbert Russell Scholarship** was established in 1942 by the Alumni Association of the Divinity School in honor of Dr. Russell, professor of biblical theology and dean of the Divinity School, 1928-1941.

**The John W. Shackford Endowment Fund** was established in 1985 by Margaret S. Turbyfill, Trinity College Class of 1940, of Newport News, Virginia, to provide student scholarships in memory of her father, John W. Shackford, who was a leader in religious education with the former Methodist Episcopal Church, South.

**The Gaston Elvin Small Family Fund** was established in 1984 by Mr. and Mrs. Gaston E. Small, Jr. of Elizabeth City, North Carolina. As an unrestricted endowment, the fund honors the Small family and their strong ties with Duke University, the Divinity School, and the United Methodist Church.

**The Dolly L. Spence Memorial Scholarship Fund** was established in 1984 by Royall H. Spence, Sr. of Greensboro, North Carolina, in memory of his wife and to provide financial support for ministerial students.

**The Hersey E. and Bessie Spence Fund** was established in 1973 by a gift from the estate of Hersey E. and Bessie Spence and designated to establish a Chair in Christian Education.

**The Hersey E. Spence Scholarship** was established in 1947 by the Steele Street United Methodist Church of Sanford, North Carolina, in honor of their former pastor and late professor in the Divinity School.

**The David Johnson and Mary Woodson Sprott Fund** was established in 1982 by the Sprott family of Winter Park, Florida, with appreciation for Duke-educated ministers and to provide student scholarships.

**The Emorie and Norman Stockton Scholarship Endowment Fund** was established in 1988 by Bishop Thomas B. Stockton, Divinity School Class of 1955, and his wife Jean, of Richmond, Virginia, in memory of his parents.

**The Earl McCrary Thompson Scholarship** was established in 1974 in honor of the late Earl McCrary Thompson, Trinity College Class of 1919, to support education for ministry.

**The Wilson O. and Margaret L. Weldon Fund** was established in 1983 by a friend to honor Dr. Weldon, Divinity School Class of 1934 and trustee-emeritus of Duke University, and Mrs. Weldon. Income from the fund is for student scholarships.

**The A. Morris and Annabel Williams Fund for Parish Ministry** was established in 1983 by Mr. and Mrs. A. Morris Williams, Jr., of Gladwyne, Pennsylvania, both graduates of Duke University. This fund honors A. Morris Williams, Divinity School Class of

1932, and the late Mrs. Williams. Income from the fund is designated for scholarships, continuing education, and creative program support for persons committed to Christian ministry through the local church.

**The A. Morris and Ruth W. Williams Professorship** was established in 1988 by Mr. and Mrs. A. Morris Williams, Jr., of Gladwyne, Pennsylvania, both graduates of Duke University. The endowment income is restricted for use by the Divinity School for a professorship in the field of parish ministry studies.

**The C. Carl Woods, Jr., Family Scholarship Endowment Fund** was established in 1988 by Mr. Woods of Durham, North Carolina, to celebrate the many ties between three generations of his family and Duke University.

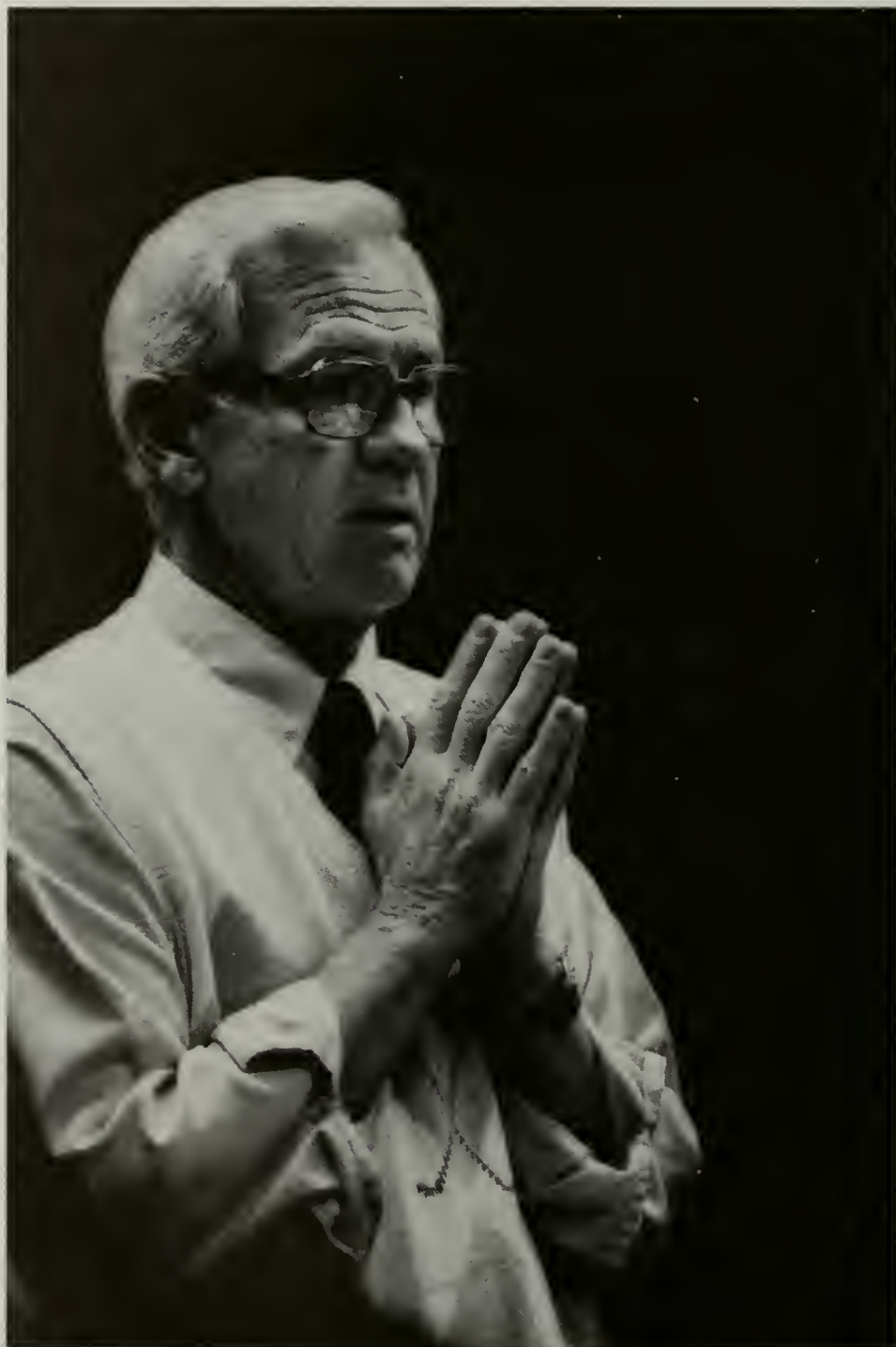
**The United Methodist Church** makes a substantial contribution to the Divinity School by designating a percentage of its Ministerial Education Fund and World Service Offerings for theological education. The general Board of Higher Education and Ministry makes available annually two national United Methodist scholarships.

**The Dempster Graduate Fellowships** are awarded annually by the United Methodist Board of Higher Education and Ministry for graduates of United Methodist theological schools who are engaged in programs of study leading to the Ph.D. degree in religion. A number of Divinity School graduates have held these fellowships.



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*Field Education*



*Harmon L. Smith, Professor of Moral Theology*

## A Program for Ministerial Formation

As the practice dimension of theological education, field learning is designed to assist students in: (1) sharpening and clarifying their Christian vocation; (2) developing identity as ministers by providing experience with a variety of ministry tasks; (3) providing a ground for the testing and reconstruction of theological concepts; (4) developing the ability to do critical and reflective thinking by relating theory and experience; (5) developing ministry skills to achieve an acceptable level of readiness for ministry; (6) integrating academic studies, personal faith experiences, and critical reflection into a personal spiritual foundation that produces a confident and effective ministry.

## Field Education Credit Requirements

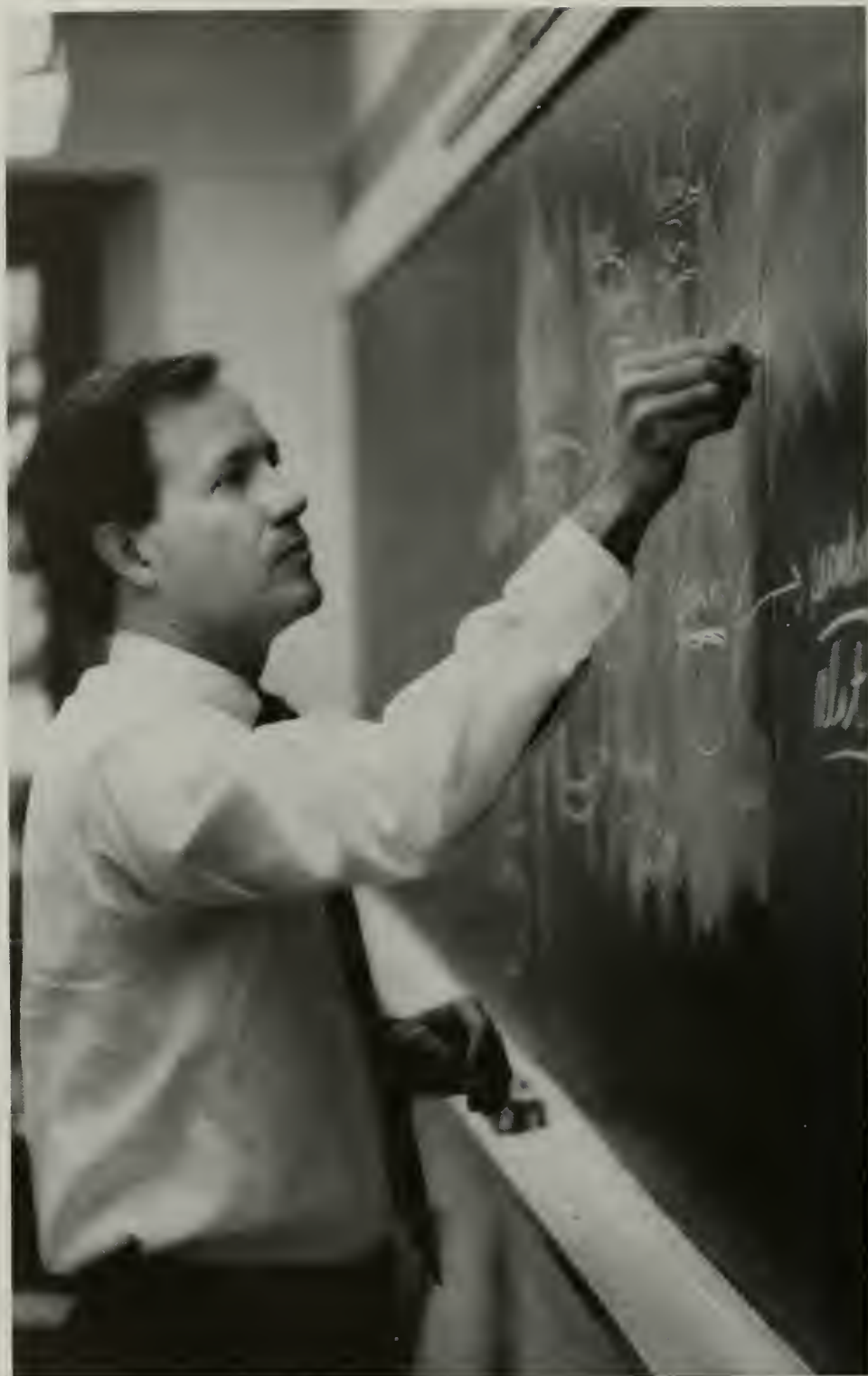
Two units of approved field education placement are required for graduation in the Master of Divinity degree program, one for the Master of Religious Education program. The Th.M. and M.T.S. degrees have no field requirements. A unit is defined by one term placement, either a full-time summer term of ten weeks or twelve weeks or an academic term of thirty weeks at fifteen hours per week. To be approved, the field setting must provide ministerial identity and role, distinct ministerial tasks, qualified supervision, a service-learning covenant, regular supervision conferences, and effective evaluation. Each unit also requires participation in orientation and reflective seminars.

To qualify for credit the student must apply and be approved for a credited placement, develop and complete a learning covenant with acceptable quality of work, cooperate with the supervisor, participate in a reflective seminar, and prepare an evaluation of the experience. Evaluation will be done by the field supervisor, student, field education staff, and the teaching faculty of Church's Ministry 100 (in the case of the second field requirement).

Prerequisite for the first field placement is enrollment in or completion of Church's Ministry 10. Prerequisite for the second placement is completion of sixteen academic credits. The first placement must be *completed* within twelve months of CM 10, the second immediately prior to or concurrent with CM 100.

## Administering Ministerial Development

Development of readiness for ministry is the responsibility of each student. If the Field Education staff questions a student's readiness for a field assignment, a committee consisting of the student's faculty adviser, a member of the Field Education Committee, and



*Dennis M. Campbell, Dean and Professor of Theology*



the Field Education staff will assess the student. Divinity School admissions materials, faculty perceptions, evaluation by the Field Education staff, and if necessary, additional professional evaluation will be used. This committee will approve the field assignment, or refer the student to remedial avenues of personal and professional development, including, if necessary, a leave of absence or withdrawal from school. Such action will be referred to the Academic Standing Committee for inclusion in assessment of that student's progress towards graduation. When, for whatever reason, a student's evaluation from a field setting raises questions about the student's ministerial learning and/or growth, or that person's use of the setting for those purposes, the same committee will be convened to assess the student and the experience and to make appropriate recommendations to the Academic Standing Committee.

## Field Settings for Ministerial Formation

Students may elect to meet their field learning requirement in one of several ways. They may elect a voluntary ministry avenue. The setting must meet the requirements set by the Divinity School, but students, with the direction of the Office of Field Education, have latitude in selecting their settings. They must invest a minimum of 300 hours in preparation and presence, a minimum of ten weeks, in the setting and comply with the requirements specified by the Divinity School.

Students may use a "private contract" field setting where they have found employment by a congregation or church agency. Again, approval by the Office of Field Education for credit, 300 hours of preparation and presence over a minimum of 10 weeks, plus compliance with Divinity School requirements regarding setting, supervision and structure are required.

Finally, field placements are often made in settings that have been developed and approved by the Divinity School. These offer opportunities for ministerial service with supervision, pastoral identity, and evaluation.

A wide variety of ministry settings is available for varying student goals: parish settings (rural, suburban, urban, larger parish patterns, and staff team ministries); institutional settings (mental health institutions, prisons, mental retardation centers, and retirement homes); campus ministry settings (positions on the campuses of a variety of schools as well as internships in college teaching); and urban ministries.

While the Divinity School offers this rich diversity of settings for personal and ministerial development, the large majority of assignments fall in local churches in small communities. Because of the Divinity School's ties with the United Methodist Church, most field placements occur in that tradition. However, the Divinity School will do everything possible to see that each student completes at least one assignment in his or her own denominational tradition. Each student is required to complete one credit in a local church setting, unless permitted by the Field Education Committee to do otherwise.

## Internship Program

A full-time program embraces both a full-time salaried position and a learning commitment in a single context over a period of time ranging from six to twelve months. These assignments are designed to engage the student in considerable depth in particular ministry skills in a setting relevant to specific vocational goals. Internships must encompass an advanced level of specialized field experience which is more complex and extensive in its serving and learning potential than the basic field education short-term placement. The internship may be individually designed to meet the needs and interests of the student, provided that the plan includes a student learning covenant, an agency service contract, approved supervisory standards, and an investigation-research project acceptable to the assigned faculty adviser. When these components are satisfactorily met and the evaluation reports are filed, credit for up to two courses (six semester hours) may be

assigned for the internship. No additional academic credit may be accumulated during the intern year. Grading for the two course credits will be on a pass/fail basis.

Internship settings may be student-initiated or negotiated by the school. In either case an agency contract covering all agreements must be made and filed with the Office of Field Education. Types of settings occasionally available for internship placement include: campus ministry and college chaplaincy positions; parish ministry positions—such as associate pastor, parish director of education; institutional positions; and a world mission internship of one to three years of national or overseas service.

To be eligible to register for an internship, the student must have completed at least one-half of his or her degree program and be registered as a student in good standing in the Divinity School. Application forms and processing for internships will be done through the Office of Field Education.

## Students Serving As Pastors

Students frequently serve as pastors of churches, or part-time associates, during the period of their study in the Divinity School. These appointments are made by the appropriate denominational official or body. The Divinity School recognizes this arrangement and recommends that the student consult with the Office of Field Education, as agent of the dean, before accepting an appointment as pastor or associate pastor.

The Office of Field Education cannot make these appointments. This is within the jurisdiction of denominational authorities, and students should initiate their own arrangements. The Office of Field Education, however, requires a student application for appointment prior to accepting one. The office also provides area church officials with recommendations for students.

Students who serve in these capacities ordinarily may enroll in no more than three courses per semester, thus requiring eight semesters to complete the Master of Divinity degree. Student pastors are not permitted to enroll in summer study of any kind. Relaxation of this regulation requires the permission (on the appropriate form) of the supervising church official, the field education staff, and the associate dean for curricular affairs. Students are strongly and actively discouraged from attempting to commute more than fifty miles one way on a daily basis. Extensive commuting will jeopardize the student's academic program, health, ministry, and family life.

In keeping with the goal of the school to develop competence in ministry, students should use their pastoral appointments as learning contexts for field education programs initiated by the school. Special seminars and reflection groups are arranged in consultation with students to advance their professional growth and guide the pastor's learning activity in the parish. Periodic evaluation will be expected in the pastor's parish, if all the conditions outlined for credit are met, and all reports are completed and filed at the appropriate time. If, however, the parish setting proves inadequate for the student's needs for ministerial growth and development, the field education staff will convene a review committee consisting of the student's faculty adviser, a member of the Field Education Committee and the field education staff to review the student's needs and take appropriate action to assist the student in growth. Examples of such action are: requiring an alternative field experience, or a basic unit of Clinical Pastoral Education, psychological evaluation, personal therapy, etc.

## Field Education and Clinical Pastoral Education

Students may use a basic unit of Clinical Pastoral Education successfully completed in an accredited CPE center to fulfill either the first or the second field education requirement. To receive field education placement credit, students must have the CPE center mail directly to the Field Education office the original or certified copy of the supervisor's final evaluation indicating the unit was successfully completed and a full unit of credit extended. The Field Education office will then notify the Divinity School registry to this

effect and both academic and field education placement credit will be extended. CPE must be taken concurrent with or within twelve months after CM 10. For field education placement II, CPE must be taken immediately prior to or concurrent with CM 100.

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*International Programs*



*Banner in York Chapel, a gift from the Methodist Church of Peru*



## A Global Perspective for Duke Divinity School

It is my hope that Duke will become even better known for its international programs. Indeed, Duke's history, resources, and outstanding faculty suggest to me that it has become our solemn obligation to serve the world community, just as it once was our duty to serve the South.

President H. Keith H. Brodie, inaugural address, September 28, 1985

When Dennis M. Campbell became dean of the Divinity School in 1983, his first administrative addition was a Committee on International Studies and Programs. "I believe," he wrote, "that the future of theological education must be seen in a global perspective and that persons preparing for ministry must encounter the reality of Christianity in the context of our whole world."

Since that time, there has been a gradual expansion of opportunities for study or travel abroad, a slow but steady growth in the number of international students in the Divinity School, and an increase in faculty participation in programs outside of the United States. Some of these are listed below. The faculty and administration of the Divinity School stand ready and eager to assist with any proposals for a broadening of theological studies in the international realm.

**The Home Country.** Duke Divinity School continues to attract students from other countries who make a significant contribution to the community. In 1986-87 there were ten international students from seven countries, in addition to two graduate scholars from abroad. In 1987-88 the number of international students remained constant, while the number of graduate students and international visiting scholars more than doubled. Because of financial limitations and the maturation of higher theological institutions in other parts of the world, a majority of these students come for a shorter period of time and for advanced degrees.

Furthermore, the Lecture Program Committee brings a succession of distinguished scholars and church leaders to speak in the Divinity School. Among these have been the following:

### Spring, 1988

The Reverend Mr. Findley McDonald, Glasgow, Scotland.

The Reverend Mr. Nathan Goto, African Council of Churches, Liberia.

### Fall, 1988

The Reverend Dr. Andrew Linzey, University of Essex, England.

Professor Gerhard Sauter, University of Bonn, Germany.

The Reverend Dr. Bonganjalo Goba, Soweto, South Africa.

The Reverend Dr. Louis Reinoso, Lima, Peru.

The Reverend Dr. Graeme Ferguson, United Theological College, New South Wales.

In addition to courses in World Christianity (including the "Christian World Mission," "Third World Theology," and "Dialogue with Other Faiths"), and courses in the history of religion under the graduate program, various other departments offer courses related to international studies: "War in the Christian Tradition," "Ethics in World Religions," "Marxist Ideology and Christian Faith," "Food and Hunger," among others. Professors Geoffrey Wainwright from Great Britain and Teresa Berger from Germany add an international and ecumenical flavor to the faculty.

**Travel Seminars.** For a number of years, under the supervision of the Center for Continuing Education, faculty members have led travel seminars to study the role of the Christian church in significant areas of social and cultural development. Each year Professor McMurry Richey (retired 1984) conducts groups of seminary students, faculty, and ministers to Mexico, generally during the spring recess. In alternate years (most recently in 1987) Professor Creighton Lacy has led a group to visit historic sites and the resurgent church in the People's Republic of China. In 1985 Professor Moody Smith conducted a seminar called "Cities of the First Christians: Athens, Corinth, Ephesus, Rome"; and other faculty members have led tours on their own initiative. Similar opportunities will be continued, and in some cases, the Center for Continuing Education has been able to provide limited financial assistance. As one example of a recent experience, three Duke students were selected by the United Methodist Council of Bishops and the Board of Global Ministries to participate in an interseminary visit to mission, refugee, and development projects in Kenya, Pakistan, and India. Last winter, two Duke students participated in a similar travel seminar, this time to study the role of the Church in Latin America.

**Study Abroad.** At the present time the only regular, on-going program of study abroad is an exchange with the University of Bonn, West Germany. Each year one German student is enrolled for a year at Duke, while an American student is selected to study in Bonn. This program, carried on for many years under the direction of Professor Frederick Herzog, has been augmented by faculty seminars: in Germany in May, 1983 on the theme of "Luther's Understanding of Human Nature and Its Significance for Contemporary Theology," with a follow-up at Duke in March, 1985, focusing on North American anthropology and Reinhold Niebuhr. Right at the moment, the Divinity School is exploring the possibility of establishing a regular exchange program with the Methodist Church in Peru. As a part of this exploration, one of our students and one of our faculty members spent the spring semester of 1989 in Lima, Peru.

Duke University is one of the supporting members of the American Schools of Oriental Research. Accordingly, students and faculty in the Divinity School have the privilege of attending the Albright Institute of Oriental Research in Jerusalem, the American Center of Oriental Research in Amman, and other similar institutions without charge for tuition. They may also compete for the four fellowships offered annually by the schools.

Individual students from time to time have made private arrangements for study abroad. These have most often taken place in England or Scotland, with academic credit usually transferrable toward the Duke degree. Other invitations have been extended from such widely-scattered institutions as Wesley College, Bristol, England; Trinity Theological College, Singapore; United Theological College, Bangalore, South India; and the School of Theology, Sao Paulo, Brazil. The International Studies Committee will assist with contacts and information for individual proposals.

**Foreign Service.** The involvement of Duke Divinity School with international institutions and cultures has always gone beyond one-way educational opportunities. Over the years faculty, alumni, and students have lived and worked in locations abroad, under both ecclesiastical and secular auspices. The latest listings include approximately a score of seminary graduates in ministry overseas, and an equal number of other Duke alumni, largely from the Ph.D. program in religion, who are serving in church-related posts. Nearly forty international students have departed to their own—or other—countries to carry on Christian ministry.

Divinity students often participate in international service projects on a short-term basis. Several have taken part in evangelistic or building work-teams, chiefly in the Caribbean area. At least one recently spent a summer in Japan holding youth services under the auspices of OMS International. Faculty, too, are engaged in a variety of activities outside the United States. In addition to innumerable conferences and lectures in Canada and Europe, professors have taught and given papers in Third World countries: e.g., Professors Lacy, Shockley, and Via at the University of Zimbabwe; Professor Langford in Singapore; Professor Westerhoff in Japan, Australia, Argentina, Peru, and other countries of Central and South America; and Professor Wainwright in Australia and New Zealand.

**Our World Parish.** "The world is my parish," said John Wesley, referring to various classes and social groups in his own country as well as the foreign mission field. Today that "foreign mission field" has become an international Christian community with much to share. Through its international programs, the Divinity School seeks to contribute to a "covenanting towards unity" with the goal of full communion among the churches of the world. We discover through our efforts as a worldwide community of faith that we are inseparable not only as members of the human family, but, above all, as members of the church catholic. We need to embody this inseparable community locally by learning from each other, standing in solidarity with each other, celebrating our common faith, and growing together. Through its international programs, the Divinity School seeks to live out its faith in a church family which transcends national, racial, denominational, geographic, gender related, political, and economic boundaries.

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*Black Church Affairs*





## The Office of Black Church Affairs

The Office of Black Church Affairs has two principal objectives: (1) to assist black and other minority students in deriving the greatest possible value from theological education; and (2) to call the entire Divinity School community to serious and realistic dialogue with the black community. In keeping with these objectives, the Office of Black Church Affairs provides the following programs, activities, and services:

**Academic Study.** American theological education has long ignored the contributions of the black religious experience, a circumstance which the Divinity School curriculum addresses through (1) black-oriented course offerings in the core curriculum and (2) the integration of black material in the content of all other courses.

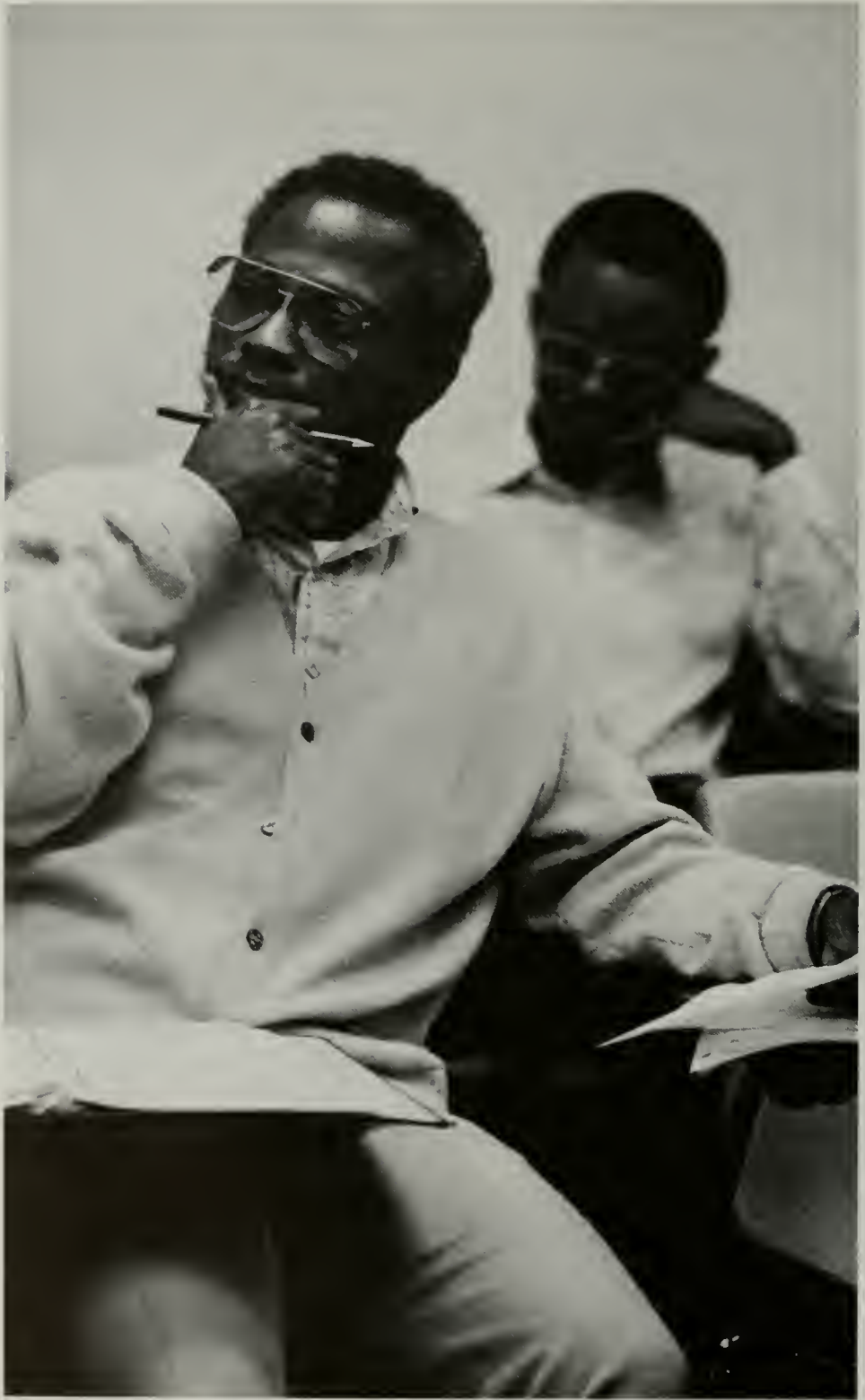
**Preaching and Lecture Series.** Fall and spring preaching and lecture series provide frequent opportunities to hear outstanding black preachers in Divinity School classes and worship services. The Gardner C. Taylor Preaching Series brings outstanding black preachers to the campus.

The Martin Luther King, Jr. Lecture Series brings to the Divinity School community lecturers of national stature to address the issues of justice, peace, and liberation in relation to the insights of the gospel and the black religious experience.

**Continuing Education.** In cooperation with the Center for Continuing Education, the Office of Black Church Affairs provides several programs for black pastors in the region, including the Gardner C. Taylor Black Preaching Series, the Martin Luther King, Jr. Lecture Series, and seminars on black concerns and issues. Occasional conferences, colloquies, symposia, and the Annual Convocation and Pastors' School supplement these offerings.

There are opportunities for academic study for all qualified black pastors and lay persons. The extensive holdings of the Divinity School Library and the services of the Henry Harrison Jordan Loan Library are also available upon application to the librarian of the Divinity School.

**Church Relationships.** Through the Office of Black Church Affairs the Divinity School reaches out to the black churches in the Durham-Raleigh vicinity. Such relationships not only afford excellent field settings for ministerial study and work, but they also provide a laboratory in which both blacks and whites together can gain wider knowledge of, deeper appreciation for, and increased sensitivity to the issues and urgencies of black culture.



The Office of Black Church Affairs also acts as a liaison with several clergy and community groups including the Interdenominational Ministerial Alliance and the Durham Ministerial Association.

The Office of Black Church Affairs provides counsel and advice to prospective black seminarians in undergraduate schools and encourages inquiries concerning study opportunities available at Duke Divinity School. For further information, contact Grant S. Shockley, Office of the Director of Black Church Affairs, Duke Divinity School, Durham, North Carolina 27706.

*Continuing Education*





## **The Center for Continuing Education**

Through the Center for Continuing Education the Divinity School offers extensive opportunities in education for the Church's ministry. The Charles P. Bowles Continuing Education Center in the new wing of the Divinity School includes seminar rooms and spacious study carrels for clergy involved in individual study or residential seminars. The Divinity School provides a year-round program of residential seminars and conferences, extension seminars and consultations, and special services to clergy and churches throughout the nation.

## **Admission and Scholarships**

Conferences, churches, and other supporting groups and institutions have made available through the Divinity School designated funds to assist in continuing education for ministry. Inquiries, applications for admission, and requests for continuing education scholarships for residential seminars should be directed to: The Reverend W. Joseph Mann, Director of Continuing Education, The Divinity School, Duke University, Durham, North Carolina 27706 (919)684-3041.

## **In-Residence Seminars and Conferences**

During the academic year 1988-89 the Divinity School conducted a series of continuing education seminars, workshops, and conferences for clergy. Some of these were: "Duke Reading Week"; "Theological Foundations for Ordained Ministry"; "Spiritual Formation and Christian Leadership"; and "Latin America: Its Church and History." In addition, special seminars were presented for many districts from the Western North Carolina Conference and the North Carolina Conference of the United Methodist Church. Current seminar schedules can be obtained through the director of continuing education.

## **International Travel-Study Seminars**

The Center for Continuing Education sponsored two international travel-study seminars in 1989. "An Introduction to Mexico" was led by Dr. McMurry Richey; "Cities of the First Christians" was led by Dr. Moody Smith. The Center for Continuing Education intends to offer clergy more opportunities for international travel and understanding.



## Extended Study Leave Program for Clergy

Duke Divinity School receives requests from clergy from all over the country to spend either a few days or a few weeks at the school. Some merely want to spend time in the library. Some want to meet with specific professors, getting from them direction for their reading or study and reflection on their thinking. Others have a particular topic or subject they wish to pursue and want the director of continuing education to point them to books, seminars, or professors that might help them. The Divinity School is happy to receive clergy for a study leave under the following guidelines:

1. The pastor submits a short biographical sketch and a study proposal.
2. The director of continuing education assesses the appropriateness of the proposal—for the pastor and for the Divinity School. When a pastor is granted permission to come to Duke on a study leave, the director of continuing education supervises the study.
3. CEU's are awarded after a discussion with the director of continuing education and a report from the pastor.

## Visiting Scholars Program

The Center for Continuing Education provides carrel space and library privileges for scholars who wish to spend an extended time at Duke while on sabbatical leave. Those interested in this program should contact the director of continuing education.

## Duke Summer Institute

The Duke Summer Institute provides a program for continuing education. Usually held the last week of July, the Summer Institute offers persons a choice of continuing education seminars, lectures, worship, and recreational opportunities at Duke. In the 1989 Summer Institute continuing education teachers included William Willamon, Richard Lischer, and Pat Arnold. Clergy have found the Duke Summer Institute a good way to combine continuing education with family vacation or travel. Inquiries about the current Duke Summer Institute can be made to the Office of Continuing Education.

## The Convocation and Pastors' School

The annual Divinity School Convocation and Pastors' School, a cooperative endeavor with the North Carolina and Western North Carolina Conferences of the United Methodist Church through the Board of Managers of the Pastors' School, brings together ministers, laypersons, students, and faculty for a series of lectures, sermons, and courses, along with alumni reunions and social occasions.

**The James A. Gray Lectures.** These annual lectures, established in 1950 as part of a bequest made in 1947 by James A. Gray of Winston-Salem, North Carolina, are delivered in the context of the Divinity School Convocation and Pastors' School. The 1988 Gray Lecturer was James Sanders from Claremont School of Theology.

**The Franklin S. Hickman Lecture.** This lectureship was established in 1966 as part of a bequest by Mrs. Franklin S. Hickman in memory of her late husband, Dr. Franklin Simpson Hickman, professor of psychology of religion, Duke Divinity School, and dean of the Chapel, Duke University. This lectureship enables the Divinity School to bring practicing ministers of extraordinary qualities to lecture and preach in the Convocation and Pastors' School and to participate in Divinity School classes, worship, and informal sessions with students and faculty. The 1988 Hickman lecturer was Doug Adams from the Pacific School of Religion.

## Duke Lay Academy of Religion

The Lay Academy of Religion offers continuing education courses for all interested persons throughout the year. The Lay Academy offers continuing education courses in the Bible, comparative religions, theology, Christian ethics, and other selected topics. Contact W. Joseph Mann, director of continuing education, Duke Divinity School, Duke University, Durham, North Carolina 27706. Call (919)684-3041 for more information and a current list of courses.

## Ministry in the Vicinity

Ministers and churches in the vicinity of Duke University are especially welcome to avail themselves of continuing education programs, facilities, and other services of the Divinity School and its faculty and students. They are invited to attend public lectures, visit with distinguished lecturers, participate in in-residence seminars and conferences, audit selected courses, study in the continuing education carrels, and use the resources of the Divinity School Library, the Henry Harrison Jordan Loan Library, and the tape recordings collection. Divinity School faculty, staff, and students are generally available for preaching, teaching, and other services in churches of the community and region.

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*Additional Study Opportunities*



*Mary McClintock Fulkerson, Assistant Professor of Theology*



## The J. M. Ormond Center for Research, Planning, and Development

This center was established in memory of the late Dr. J. M. Ormond, professor of practical theology at Duke Divinity School and director of the rural church program under the Duke Endowment, 1923-48. The North Carolina Annual Conference established the J. M. Ormond Fund in 1951 as part of the special effort of the North Carolina and the Western North Carolina Conferences of the United Methodist Church to provide additional programs at the Divinity School. The center is directed by Dr. Robert L. Wilson, professor of church and society. It is jointly supported by the Ormond Fund and the rural church section of the Duke Endowment.

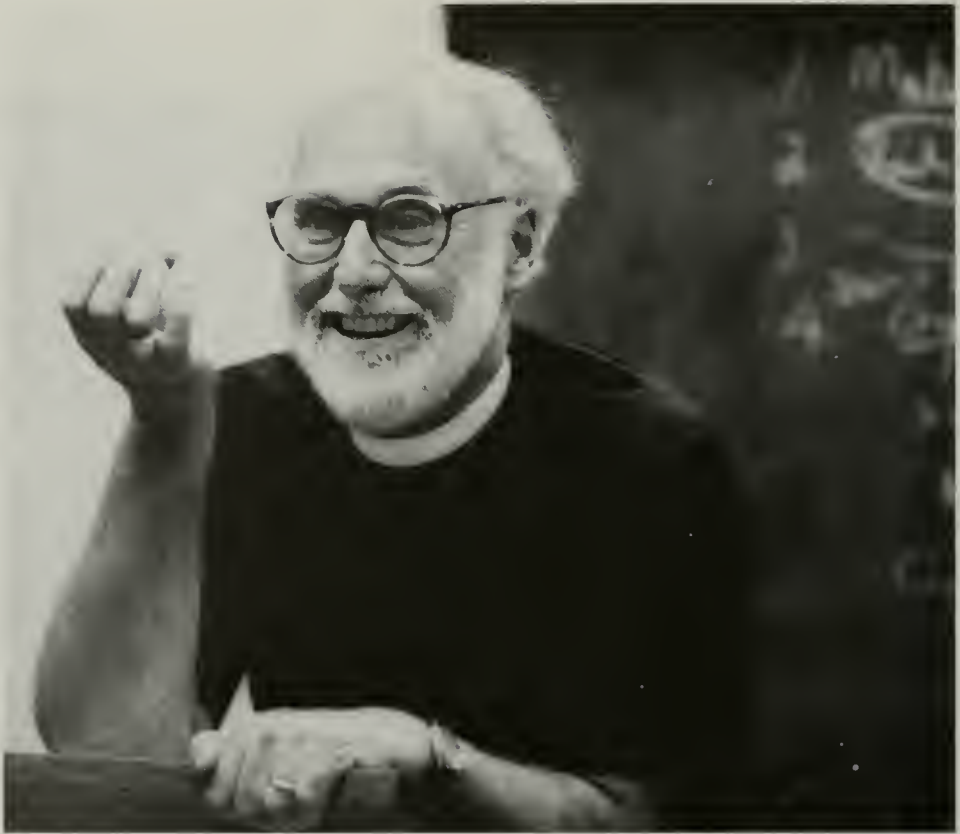
The center has three purposes. First, it assists the Church in its ministry by providing research and planning services. Second, it provides training for ministerial students in church and community studies. Third, it contributes through basic research to the understanding of the nature and functioning of the Church. Emphasis is given to research and planning studies of rural United Methodist Churches in North Carolina.

## Programs in Pastoral Psychology

Programs in pastoral psychology beyond the studies incorporated in the M.Div. curriculum are provided in cooperation with the Duke University Medical Center. Two such programs are available.

1. The Master of Theology degree with a major in pastoral psychology is ordinarily a calendar year program beginning the first full week in June. However, upon the recommendation of the staff, candidates with a quarter or more of clinical pastoral education may begin their program in September. The candidate may plan one of two programs or concentrations:  
(a.) a concentration in pastoral theology relating psychology and theological understanding to professional ministry, especially the parish, through course work and supervised field or clinical experience; and (b.) a concentration in pastoral care and an introduction to the field of pastoral counseling through course work and an intern year in clinical pastoral education.

A quarter of clinical pastoral education is considered a prerequisite for all programs. Students who wish to complete the intern year in CPE and earn a Master of Theology degree will normally need two years to complete the program.



*John H. Westerhoff III, Professor of Religion and Education*

In the context of clinical pastoral education various professional goals may be sought including general understanding and skills in pastoral care and specialization in pastoral counseling and clinical supervision. Persons specializing in pastoral counseling and pastoral psychotherapy will advance toward certification with the American Association of Pastoral Counselors and the American Association of Marriage and Family Therapists.

2. Single units of basic clinical pastoral education are offered each summer (beginning the first Monday in June and running for eleven weeks) and concurrent with the fall and spring semesters in the Medical Center. Single units of basic parish-based clinical pastoral education are available concurrent with the fall and spring semesters. When the unit is completed within one semester, the student may take two other courses in the regular M.Div. program. Two transfer course credits will be granted for a summer CPE quarter or two course credits will be granted for the unit taken during the academic year (unless a course credit has already been granted for PP 77, in which case only one additional credit will be given for the CPE unit).

Students in CPE may not have other field education appointments or employment. However, a CPE unit will, when satisfactorily completed, count as one field education placement. Only one field education requirement may be fulfilled by CPE. For further information consult the Office of Field Education.

Students are reminded that ordinarily no more than five courses out of twenty-four for the M.Div. degree should be taken in any one subdivision.

3. A one-year certificate or nondegree internship program in clinical pastoral education is available through the Duke Medical Center for persons who hold the Master of Divinity degree or its equivalent. Also, students who wish to pursue a pregraduation intern year are invited to apply, provided they have completed at least one year of theological education. The certificate, nondegree intern year can be done at any level of clinical pastoral education (basic, advanced, supervisory) which the candidate and the supervisory staff judge appropriate. These persons may enroll in the Divinity School as Special Students for a course or two each semester. Such training usually provides four units of certified clinical pastoral education credit.

Admission to either the basic unit or the internship program of clinical pastoral education is distinct from admission to the Divinity School. Applications for CPE enrollment are available in the Chaplains Service Office, Duke Medical Center.

For further information concerning any of these programs, write to Director, Programs in Pastoral Psychology, Duke Divinity School. See the section on the Master of Theology degree program.

## Women's Studies at Duke University

Graduate students enrolled in any of Duke University's departments and professional schools may participate in the Women's Studies Program by taking graduate level courses, working with Women's Studies faculty on independent research, pursuing the graduate certificate in Women's Studies, and writing masters and doctoral theses in feminist scholarship.

To qualify for a graduate certificate, students must pass a minimum of three graduate level courses on women and gender. IDC 211, *History of Feminist Thought*, is the core course for the certificate, and the only required one. Students choose the second and third courses, as suited to their interests and programs of study. These may include Divinity School courses: CT 214, *Feminist Theology*; CT 139, *Women, Theology and the Church*; PP 180, *Pastoral Care and Women*; and PR 282, *Women and the Word*; as well as two other IDC courses: IDC 283, *Feminist Theory and the Humanities*; and IDC 284, *Feminist Theory and the Social Sciences*. (Divinity students may elect IDC 211 as one of their two permitted cognate courses [see below for "Cognate Courses"], and may wish to expend the other cognate opportunity on IDC 283 or 284.)

In addition to coursework, graduate students interested in feminist scholarship are strongly encouraged to take advantage of the many cocurricular and professional opportunities the Women's Studies Program presents.

(For relation of this opportunity to requirements of the several degree programs, see below. Note especially the "Required Limited Elective" in Theologies in Context which is part of the M.Div. degree.)

## The Ministerial Course of Study School

In cooperation with the Division of Ordained Ministry of the Board of Higher Education and Ministry and the Southeastern Jurisdictional Conference of the United Methodist Church, the Divinity School hosts the Course of Study School for local pastors of the United Methodist Church. This school is in session for four weeks each summer, and the required studies for one full year can be completed in this period. This is not a part of the regular work of the Divinity School degree program, and no credit toward a seminary degree can be earned. The faculty includes representatives from the Divinity School and other church-related institutions. The fortieth session of the Course of Study School is being held 26 June-21 July 1989. For further information on the Course of Study School write to Dr. Paula E. Gilbert, Director, Ministerial Course of Study School, Duke Divinity School, Durham, North Carolina 27706.

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*Curriculum*





## Degree Programs

The academic work of the Divinity School presently embraces four degree programs: the Master of Divinity degree (M.Div.), ordinarily of three academic years; a one-year program beyond the basic degree, the Master of Theology (Th.M.); and two programs of two academic years, one leading to the degree of Master of Religious Education (M.R.E.) and the other to the degree of Master of Theological Studies (M.T.S.). The first three are graduate-professional degrees; the M.T.S., inaugurated only in September of 1987, is a general academic degree. Admission to candidacy for any of these degrees presupposes the completion of the A.B. or its equivalent.

Students preparing for ordination to the Christian ministry and requiring appropriate graduate-professional education will enroll for the Master of Divinity degree. Students whose acquired academic standing, under this basic degree program, entitles them to further specialized study may advance their command of selected theological disciplines by applying for an additional year of studies leading to the Master of Theology degree. Together, these two degree programs constitute a sequence. Although the Master of Divinity degree fulfills requirements for ordination by prevailing ecclesiastical standards, the Th.M. program may assist in assuring a larger measure of professional preparation. Application for admission to the Th.M. program is open to graduates of other schools who have completed the basic theological degree.

The Master of Religious Education degree program is designed to prepare qualified persons, ordinarily not seeking ordination, for a ministry of Christian education in local churches or other organizations. The course of study is arranged to provide grounding in biblical, historical, and theological disciplines as essential background for instruction in and exercise of professional competence in curricular planning, teaching methods, and supervision of educational programs for various age groups. The Master of Theological Studies provides an introduction to the theological disciplines as foundation for a graduate research degree (Ph.D.); preparation for lay religious degrees other than Christian education; grounding for teaching, research or practice in another field (e.g., history, psychology, music); enhancement of institutional roles; and personal enrichment.

The specific requirements for each of these degrees are found in the succeeding pages. Completed course work cannot be credited toward more than one degree. Reciprocal transfer of credit for course work taken under the M.Div., M.R.E., or M.T.S. programs requires the permission of the associate dean for academic programs.

## Doctoral Studies Accredited by the Graduate School

The Divinity School provides a substantial body of course offerings to an advanced level in biblical, historical, systematic and contemporary theological disciplines that are accredited by the Graduate School and the faculty of the Divinity School, and lead to the Doctor of Philosophy degree. Sharing responsibility with the University Department of Religion for staffing and curricular provisions of this course of study, the Divinity School is the principal contributor to the program of graduate studies in religion. However, since the Ph.D. in religion is certified and awarded under the Graduate School, the doctoral student's admission and matriculation are administered under that division of Duke University.

With few exceptions, most courses in the *Bulletin of Duke University: The Divinity School* carrying a 200 number or above and belonging to the fields noted above are applicable to doctoral programs of study. These courses are open to qualified M.Div., Th.M., M.R.E., or M.T.S. students by permission of the instructor.

Qualified persons who desire to pursue studies leading to the degree of M.A. or Ph.D. in religion, under the administration of the Graduate School, are advised to apply to the dean of that school. Inquiries concerning fellowships or specific requirements of the Program of Graduate Studies in Religion may be addressed to the Director, 209 Divinity School.

## Administration of the Curriculum

Students are required at the time of each registration period to plan their course of study with the consultation and approval of their assigned faculty advisers. Such programs are subject to the review and approval of the Committee on Academic Standing, the dean, and the associate dean for academic programs. It is the responsibility of each student to see that all requirements for graduation (and for ecclesiastical ordination) are met, and that any special permission granted to deviate from the normal program is properly recorded on the personal files in the registry.

**Grading System.** The Divinity School employs the grading scale with the following letters, *A, B, C, D*, and *F* which have been defined as follows: *A*, excellent; *B*, good; *C*, satisfactory; *D*, passing; *F*, failure; *WI*, withdrew illness; *W*, withdrew, discretion of the Dean; *I*, incomplete; *P*, passed; *NC*, noncredit; *Z*, year course. At the discretion of the instructor, individuals or classes may in certain instances be graded simply as pass or fail. Such *P/F* grades shall be limited to no more than 25 percent of a student's total curriculum at Duke and will not be figured in the grade point average.

The denotations are defined as follows according to quality points: *A*, 4; *A*, 3.7; *B+*, 3.3; *B*, 3.0; *B*, 2.7; *C+*, 2.3; *C*, 2.0; *C*, 1.7; *D+*, 1.3; *D*, 1.0.

**Limited Program.** Students whose work after admission is not satisfactory may be placed on limited programs by the Academic Standing Committee and are required to reduce their course loads or to make other academic adjustments. Students who during the first year of Divinity School maintain less than a *C* (2.0) average, including failures, ordinarily will be required to withdraw from the school.

**Incompletes.** A student may petition the associate dean for academic programs to receive a grade of incomplete in a course. This petition must be filed in writing on the prescribed form with the registry on or before the last official day of classes of the semester in question. Such permission may be granted when a student, through some circumstances beyond control, such as illness, has been hindered from meeting the course requirements. Adjudication of the petition will rest with the associate dean and the instructor concerned. The associate dean will communicate in writing to the student regarding the joint decision and any conditions attached thereto. An incomplete becomes either an *F* or a permanent incomplete unless it is removed through completion of assigned work

by the following dates: for incompletes incurred in fall semester courses, 1 February; for incompletes incurred in spring semester courses, 15 September. The grade of permanent incomplete is reserved for instances in which the student's work in the course was substantial and of passing quality.

**Change of Courses or Withdrawal.** Students are permitted to change their course registrations, without incurring a penalty, during the prescribed drop/add period at the beginning of each semester. Any alteration in the number of courses must be officially reported and recorded. The adding of a course requires the permission of the instructor of that course as well as the student's faculty adviser. Any refund of tuition related to withdrawals will be according to the published schedule.

No student will be permitted to withdraw from a course after one-half of the semester without incurring failure, except for causes adjudged by the associate dean for academic programs to be beyond the student's control. Conditions of genuine emergency and not considerations of convenience will be determinative in considering requests, which must be submitted in writing on academic petition forms.

**Leave of Absence.** A student wishing to take a leave of absence for one or two semesters, and intending to return to a degree program in the Divinity School, should so notify the associate dean for academic programs in writing in advance. No leave of absence will be granted for more than one full academic year, although an emergency extension may be requested from the associate dean for academic programs.

**Withdrawals from School.** Students deciding to withdraw from the Divinity School, for whatever reason, should consult with their faculty advisers and the associate dean for academic programs, and must file a written statement of withdrawal prior to departure. All students who have officially withdrawn or whose leave of absence extends beyond one academic year but who wish later to return to the Divinity School will be required to reapply for admission, and provide whatever documentation is required by the director of admissions.

**Directed Study.** Students may, with permission of their faculty advisers and the instructors involved, take one or two units of directed study, preferably not in the same semester. These independent study courses under individual faculty supervision are ordinarily in subjects at an advanced level which cover material not available in the regular curriculum. Students wishing to take more than two courses by directed study must have permission from the associate dean for academic programs in consultation with the student's faculty adviser and the instructor who agrees to direct that study.

**Cognate Courses.** Students may, in consultation with their faculty advisers, take up to two graduate level courses in other departments of Duke University or at the University of North Carolina. Permission for more than two such cognate courses must be secured from the associate dean for academic programs. Courses in the Duke Department of Religion do not count within this limit.

**Graduation with Distinction.** Students who achieve a grade point average of 3.85 for overall academic records in the M.Div. and M.R.E. programs are granted the degree *summa cum laude*. Students with a grade point average of 3.65 or above are awarded their degrees, *magna cum laude*. Such distinction is calculated on the basis of letter grades only, totaling at least three-quarters of all courses taken at Duke, and will be indicated on the student's diploma.

**Part-Time Students.** Students taking fewer than three courses in any given semester are considered part-time students and are ineligible for financial aid from the school.

**Auditors.** Full-time students paying for at least three courses are permitted to audit additional courses, if space permits, with the approval of their advisers, the associate dean for academic programs, and the instructor of the class. Special students, part-time students, or persons not candidates for degrees in the university are charged an audit fee for each such course.



## The Basic Theological Degree—Master of Divinity

The faculty of the Divinity School views the curriculum as dynamic, not static; constantly endeavors to review the curriculum as a whole and to tailor individual courses to meet the needs of a rapidly changing world; and periodically commits itself to overall curricular change. Major curricular revisions were instituted in 1948, 1959, and 1967. Another such revision took effect in September of 1987.

This degree program is structured to elicit a positive response to: (1) the challenge to provide an adequate professional education—education for ministry; (2) the needed variability of ministries in today's complex world; (3) the norms of university education; and (4) the Christian tradition.

**Aims of the Curriculum.** The aims of the basic degree program focus upon four goals, four areas of personal and curricular responsibility, four lifelong tasks which should be strongly advanced during the seminary years.

1. *The Christian Tradition.* To acquire a basic understanding of the biblical, historical, and theological heritage.
2. *Self-Understanding.* To progress in personal and professional maturity—personal identity, life-style as an instrument of ministry, major drives, handling of conflict, resources, and professional competency and so forth. This is to be coupled with a sensitivity to the world in which we minister—its social forces, its power structures, its potential for humanization and dehumanization.
3. *Thinking Theologically.* To have the ability to reflect about major theological and social issues and to define current issues in theological terms and theological issues in contemporary secular terms.
4. *Ministering-in-Context.* To have the ability to conceptualize and participate effectively in some form of contemporary ministry.

Goals of such scope cannot be neatly programmed in any curriculum, and the degree of achievement (in seminary and beyond) will vary with individuals and their own motives and incentives.

**The Basic Curriculum—General Description.** Graduation requirements for the Master of Divinity degree consist of satisfactory completion of twenty-four courses, with an overall grade point average of C (2.0) or better; ten basic courses or their equivalent; three limited electives; two units of approved field education; and two evaluations.

The basic curriculum provides for foundational courses in biblical, historical, theological, and ministerial studies, representative of the tradition and regarded as indispensable background for subsequent elective work and individual program information. These required courses total ten of the twenty-four courses necessary for graduation. They are Old Testament 11, New Testament 18, Church History 13 and 14, American Christianity 28, Christian Theology 32, Christian Ethics 33, Preaching 30, Church's Ministry 10 and 100. At least one course must be elected from three designated lists of offerings (available at registration) in advanced Biblical Studies, Black Church Studies, and Theologies in Context (the latter covers such fields as Women's Studies, World Christianity, and Liberation Theology). The opportunity of advanced standing adds further variability to the academic program, depending upon the nature and quality of the student's undergraduate academic work. Fourteen courses, over half of the required total, are available for working out an individualized program of studies leading to specialized preparation in academic depth and for purposes of professional ministerial competence.

Required courses may be staffed by one or more professors and are planned to treat subject matter both in scope and depth at the graduate level.

The formulation of the student's course of studies is guided by certain broad but normative recommendations for area distribution of courses and by the advice and counsel of appointed faculty advisers or authorized directors.



Students and advisers are directed to read diligently the paragraphs on elective studies and professional aims and distribution of elective studies in the section on administration of the curriculum.

All academic programs are subject to review and emendation by the dean and the associate dean for academic programs for the fulfillment of the aims of the curriculum. The declared vocational and professional objective of the student is of central importance both to the student and to the faculty adviser in planning the student's comprehensive study program.

Six semesters of residential study are ordinarily required for the completion of the degree. With permission of the associate dean for academic programs, certified non-residential study, not exceeding the equivalent of eight courses, may be permitted to a candidate for the basic degree.

The normal academic load is four courses per semester. A student with demonstrated competence may, with the consent of the academic adviser and the associate dean for academic programs, enroll for an additional course in the middler and senior years.

**General Features of the Basic Curriculum.** The following is a brief summary of the basic curriculum.

1. Twenty-four courses and six or more semesters of residency are required for graduation.
2. Each student is required to complete two approved assignments in field education (with or without remuneration) under supervision.

Such assignments might include an internship, a summer of full-time work, two semesters of part-time work, or involvement in church or community service. The essential criteria for graduation credits are that the amount and quality of supervision be approved by the Office of Field Education, and that the student be required to evaluate and correlate the experience directly.

3. A normal academic load is four courses with credit.

Admission to candidacy for the Master of Divinity degree is admission to the regular program of studies. The suggested paradigm defines the normal sequence of the student's developing program. Students enrolled for less than three courses are considered part-time and are not eligible for financial aid or student health services.

The curriculum intends to serve graduate-professional aims with maximum flexibility. Fourteen elective courses are available and may be programmed to satisfy vocational and professional preferences. In planning a course of study, the student, in consultation with the adviser, should choose a program which will give a broad understanding and appreciation of future professional responsibilities. Members of the faculty and staff welcome inquiries.

Professional ministries include those of the parish, preaching, teaching, and pastoral care; ministries of education in local churches and higher education; missions; campus ministry; specialized urban and rural ministries; chaplaincies—hospital, institutional, industrial, and military; teaching; religious journalism; audiovisual communications; church agencies; and ecumenical ministries at home and abroad. For many of these, further specialized training will necessarily be sought elsewhere beyond the basic degree. For all of these ministries the student's program of studies can be shaped for the particular ministry in view.

Students are encouraged to elect at least one course in each of the following areas or subdivisions of the curriculum beyond the required courses: American Christianity; history of religion; Christian education; world Christianity and ecumenics; biblical exegesis; pastoral psychology; Christian ethics; worship and preaching; care of the parish (including church and community). Such advanced courses should be selected with a view to the individual's vocational and professional aims and in consultation with the student's faculty adviser. Students are also encouraged to concentrate, usually in not more than five courses in any one subdivision of the curriculum, in an area directly related to their

vocational and professional intention. The program of each student is subject to review and revision by action of the faculty adviser, the Committee on Academic Standing, the associate dean for academic programs, or the dean.

**Evaluation/Self-evaluation.** The successful completion of the new M.Div. program rests upon three components: (1) grades; (2) field education; (3) faculty evaluation. Two points of evaluation/self-evaluation occur. One, after the first semester and as an aspect of Church's Ministry 10, provides an early reading on the student's sense of vocation and the appropriateness of the Duke M. Div. program for that person; gives early direction to the student's academic program; provides guidance for the first field assignment.

The second, normally after the fourth semester and as part of Church's Ministry 100, reviews the student's progress to date in classroom and field learning and assesses the student's readiness to proceed into the senior year and complete the Master of Divinity program. Specifically examined are the student's (1) understanding of his/her Christian vocation, (2) self-perception as person in ministry, (3) command of skills of ministry, and (4) ability to integrate practice and theology of ministry.

The instruments to be used for the second include (1) a self-evaluation document; (2) field education data and transcript; (3) a 15-25 page typewritten paper on the student's emerging theology of ministry in relation to his/her given faith heritage; (4) an episode of ministry such as a verbatim, a sermon, a case study, a church program, etc., which demonstrates the theology of ministry; and (5) a 45 minute oral exam over the paper, specific episode, etc.

The evaluation is a graduation requirement which must be satisfied as any other requirement. Students who require significant additional work as judged by the evaluating committee will have to complete that work prior to graduation.

Information from the evaluation is protected by the statutes concerning privacy and confidentiality. It will not be shared by the Divinity School with any extra-university party except upon written release of the student and then only in summary fashion.

#### A SUGGESTED M.DIV. CURRICULAR PARADIGM

##### **Junior Year**

###### *Fall Semester*

Church's Ministry 10

Church History 13

Old Testament 11

Elective

(Evaluation 1)

Field Education 1

###### *Spring Semester*

Christian Theology 32

Church History 14

New Testament 18

Elective

##### **Middler Year**

###### *Fall Semester*

Christian Ethics 33

Preaching 30\* (or Elective)

American Christianity 28

Elective

Field Education 2

###### *Spring Semester*

Elective

Preaching 30\* (or Elective)

Elective

Elective

(Evaluation 2)

##### **Senior Year**

###### *Fall Semester*

Church's Ministry 100

Elective

Elective

Elective

###### *Spring Semester*

Elective

Elective

Elective

Elective

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\*Students will take the Introduction to Preaching course before the end of the fourth semester and after the foundational courses in Old and New Testament or their equivalents.

**Required Limited Electives:**

One course in Black Church Studies (from designated list)

One course from Theologies in Context (from designated list of courses treating Women's Studies, World Christianity, Liberation Theology)

One additional course in Scripture.

The third requirement in Scripture may be met in one of the following ways:

(1) by the course entitled "The Interpretation of Scripture" (OT/NT 150); (2) by the Biblical language sequences OT 115-16 or NT 103-4 (or an advanced language course in which a formal exegetical paper is required); (3) by an English exegesis course in which a formal exegetical paper is required (the courses to be specified in registration materials); (4) by a Greek or Hebrew exegesis course.

**Field Education.** Two units of approved field education are required; they are represented above as winter term placements (30 weeks); they may also be satisfied in summer placements (10-12 weeks).

**Student Pastors and Others with Heavy Outside Employment.** Students in candidacy for the Master of Divinity degree who serve as full-time pastors or work more than fifteen hours per week in addition to their academic schedule are advised that their degree programs will usually require a fourth academic year.

Modification of this schedule requires the approval of the associate dean for academic programs on recommendation of the associate dean for field education.

1. Students with pastoral charges or comparable extracurricular responsibilities ordinarily will enroll for not more than three courses.
2. Students who accept pastoral charges in their middler or senior year are required to have the prior approval of the associate dean for field education. Such students will be required to restrict their course work in accordance with regulation 1 above.
3. Modifications of these regulations will be scrupulously administered. Academic achievement, normally a *B* average, must be demonstrated before any modification of these requirements is allowed. Since adequate indication of the student's academic proficiency is not available before the completion of the first academic year, no modification of regulation 1 is possible for junior students.
4. Students who secure minor employment outside the channels of the Office of Field Education are required to inform the associate dean for field education. Students carrying an outside employment work load of more than fifteen hours per week will be required to limit their academic load.
5. Ordinarily a student may not commute more than fifty miles (one way). Students living farther away than this will be required to stay in Durham during the academic week.
6. Student assistant pastors (not pastors-in-charge) may enroll for a full academic load if they are not on limited program, if their work is under the supervision of the associate dean for field education, and if their field duties involve no more than fifteen hours per week.

**Study Abroad.** Study abroad, with transferable credit toward graduation, may be allowed for a candidate for the Master of Divinity degree by approval of the associate dean for academic programs. A strong academic record is a prerequisite. Ordinarily, permission for such study may be granted to students who have completed the work of the middler year. Both the institution abroad and a specific course of study proposed must have the prior approval of the associate dean for academic programs. Required courses and the two field education units must usually be completed at Duke.

**Transfer Credits.** Transfer of credit to the Divinity School of Duke University, leading to candidacy for the degree of Master of Divinity, will normally be limited to one-third



of the academic credits (in proportional evaluation) required for fulfillment of degree candidacy (see the chapter, "Admissions").

**Advanced Placement.** Students may, on the basis of undergraduate courses, a religion major, or other substantial preparation, be given advanced placement in one or more of the eight required subjects. Such placement normally presumes at least two college courses in a given area (e.g., Old Testament) with a satisfactory grade average and permits the student to fulfill the requirement by electing an advanced course in the same area (e.g., an advanced Old Testament course in place of Old Testament 11).

**Ordination Requirements.** Students preparing for ordination are strongly advised to ascertain early in their seminary program the precise ordination requirements of their denomination.

United Methodist students must fulfill educational requirements in the *Discipline*, by completing the year-long course on Methodist doctrine, history, and polity (CP 159 and 160). Most annual conferences also require one or more courses in preaching and worship and/or clinical pastoral education.

Students from other denominations should consult with their appropriate church bodies for specific requirements, which may include biblical languages. Polity courses for certain other denominations may be offered from time to time by faculty members or local clergy on prior request.

**Continuation Requirements.** The following are the continuation requirements for students enrolled in the M.Div. degree program:

1. The student must maintain a cumulative grade point average of 2.0. If a student falls below this level he or she may be terminated or warned and placed on limited program. This means that the student may enroll in no more than three courses.
2. At the end of the second semester the student on limited program who does not attain a cumulative GPA of 2.0 is terminated. In exceptional cases a student who shows substantial improvement the second semester but does not quite attain a GPA of 2.0 may be given a third semester to do so.
3. The progress of all students is reviewed at the end of every semester by the Academic Standing Committee.

The M.Div. degree must be completed within six years (twelve semesters). The minimum time in which a degree can be completed is three years (six semesters).

To be classified as full time, a student must be enrolled in three or more courses in a semester.

**M.Div. with a Concentration in Christian Education.** Persons wishing a Master of Divinity degree with a concentration in Christian education will complete the stated requirements of the M.Div. curriculum. In addition, they would ordinarily take CED 25 in the first semester of the junior year; CED 132 in the first semester of the middler year; CED 250, the Senior Symposium in Christian Education, in the second semester of the senior year; and three other Christian education courses. They would also complete one field education unit in a Christian education setting.

## The Master of Religious Education Degree

The course of study leading to this degree is designed for persons desiring to prepare for leadership and service in the educational ministry of the church.

**Admission.** Applications for admission to the Master of Religious Education program are evaluated by the same standards as those applicable to the Master of Divinity degree, and admission requirements and procedures are also the same (see page 25, "Admissions: Requirements and Procedures"). Students planning to specialize in Christian education should study the sections of this bulletin which contain statements of policy regarding



the most appropriate prerequisite studies for theological education and the procedures to be followed in applying for admission.

**Requirements.** The Master of Religious Education degree usually requires two years, or four semesters, of residence and study and the fulfillment of the following requirements:

1. Sixteen courses according to the following curricular paradigm:

#### **First Year**

##### *Fall Semester*

CED 25: Education as a Pastoral Ministry

Church History 13

Old Testament 11

Elective

(evaluation-1)

##### *Spring Semester*

Christian Theology 32

Church History 14

New Testament 18

Elective

#### **Second Year**

##### *Fall Semester*

Christian Ethics 33

CED 132: Curriculum Teaching and

Learning

Elective

Elective

(evaluation-2)

##### *Spring Semester*

CED 250: MRE Symposium

Elective

Elective

Elective

Required Limited Electives: Three courses in Christian Education. One unit of approved Field Education is required.

**Note:** The courses in scripture, history, and theology above are those typically elected. Others in the same divisions may be substituted with the permission of the adviser, the divisional chair, and the associate dean for academic programs.

All M.R.E. students will be involved with their adviser in two evaluation/self-evaluation processes. One, after the first semester, provides an early reading on the student's sense of vocation and direction. The second, normally during the third semester, assesses the student's readiness to complete this professional degree program. The latter includes the submission of a fifteen-twenty page paper entitled "My Emerging Theology of Educational Ministry." Both draw upon insights and data from field education as well as from academic performance.

**United Methodist Requirements.** This degree meets the academic requirements for consecration as a diaconal minister in the United Methodist Church when United Methodist doctrine and polity (CP 159-60) are taken as electives. To be certified as a director or minister of Christian education by an annual conference, a student would need to take a course in worship, typically CW 178, and United Methodist history, doctrine and polity (CP 159-60), in addition to the courses in Christian education required for the degree. Students are advised to consult with their Conference Boards of Diaconal Ministry.

**Continuation Requirements.** The following are the continuation requirements for the M.R.E. degree program:

1. The student must maintain a cumulative grade point average of 2.0. If a student falls below that he or she may be given a second semester to bring the cumulative GPA up to 2.0. Failure to do so results in termination.
2. The progress of all students is reviewed at the end of every semester by the Academic Standing Committee.

The minimum time in which the M.R.E. can be completed is two years (four semesters). The degree must be completed in four years (eight semesters).

To be classified as full time a student must be enrolled in three or more courses.

# The Master of Theological Studies Degree

This two-year (four semesters) general academic degree, inaugurated in September of 1987, is designed to provide an introduction to the theological disciplines as: (1) foundation for a graduate research degree (Ph.D.); (2) preparation for lay religious careers; (3) grounding for teaching, research or practice in another field (e.g., history, psychology, music); (4) enhancement of institutional leadership roles; (5) personal enrichment.

## Requirements:

1. 16 courses and four or more semesters of residency (at least three semesters of which must be at Duke, i.e., transfer credit is limited to one semester);
2. a normal load of four courses per semester;
3. two courses from each of the biblical, historical and theological divisions (ordinarily those would be the Old and New Testament introductions; the two semester survey of church history; and the basic theology and ethics courses);
4. the maintenance of a cumulative grade point average of 2.5;
5. a paper\* submitted within a course in the final (fourth) semester and fulfilling, in part, the requirements of that course which addresses itself to the coherence, learnings, or major emphases of the individual's program (choice of course by mutual consent of student, instructor, adviser);
6. completion of all requirements for the degree within a four year (eight semester) period.

**Administration.** In consultation with their advisers, students will draft a set of program goals and project a four semester course plan (or an appropriate alternative plan on a part-time basis). At each registration conference, students and advisers will reassess program goals and the course plan adopted by the student. At the end of each semester, the Academic Standing Committee shall review the progress and cumulative grade point average of each student. The M.T.S. program as a whole will be administered by the associate dean for academic programs who will take responsibility for any colloquia or other special M.T.S. programs.

Persons enrolled for three or more courses will be classified as full time.

Students enrolled in the M.T.S. program do not ordinarily elect Church's Ministry 10 and 100 or Christian Education 250.

**United Methodist Requirements.** This degree meets the academic requirements for consecration as a diaconal minister in the United Methodist Church when United Methodist doctrine and polity (CP 159-60) are taken as electives. Students are advised to consult with their Conference Boards of Diaconal Ministry.

## A Suggested M.T.S. Curricular Paradigm

### First Year

#### *Fall Semester*

Elective  
Old Testament 11  
Church History 13  
Elective

#### *Spring Semester*

Christian Theology 32  
New Testament 18  
Church History 14  
Elective

### Second Year

#### *Fall Semester*

Christian Ethics 33  
Elective  
Elective  
Elective

#### *Spring Semester*

Elective\*\*  
Elective  
Elective  
Elective

\*Guidelines for the fourth semester paper will be available.

\*\*One of the electives serves as the context for the summary paper.

# The Master of Theology Degree

The course of study leading to the degree of Master of Theology is designed for graduates of accredited theological schools who desire to continue or resume their theological education for enhancement of professional competence in selected areas of study. Enrollment in the Th.M. degree program is open to a limited number of students who have received the M.Div. (or the equivalent) with superior academic records.

Inquiries on admission may be addressed to the director of admissions for referral to the director of the Th.M. Program.

**General Requirements.** The general requirements for the degree of Master of Theology are:

1. Eight course units of advanced studies, with an average grade of *B* (3.0 average on a 4.0 scale).
2. Superior performance in a comprehensive examination covering the major area of study. As an alternative to the comprehensive examination the student may elect to do a research project in one major area if approved by the supervising professor. This project shall carry one course credit, to be counted within the eight units required.
3. Residence for one academic year or the equivalent. (Equivalency to be determined by the associate dean for academic programs).

There are no general language requirements. However, classical or modern languages may be required for certain programs (for example, in biblical studies, Hebrew or Greek may be required).

**The Program of Study.** At least four of the required eight courses must be taken in one of the basic theological disciplines (biblical, historical, theological, or ministerial) which shall be designated as the candidate's major, and at least two courses in another discipline (i.e. an area of study distinct from the major) which shall be designated as the candidate's minor. Ordinarily, no more than two units may be taken through directed reading, and no more than one of these in any one semester. In the area of pastoral psychology, up to four course units may be taken through clinical pastoral education.

The comprehensive examination will be given at the close of the course of study for the degree, ordinarily in May or September. Persons electing to do a research project should obtain guidelines for their submission from the associate dean for academic programs.

The entire program of studies and comprehensive examination or project can be completed within twelve months. In some cases, the time limit may be extended, but in no case beyond three years.

The candidate majoring in pastoral psychology may plan one of three programs or concentrations: a concentration in pastoral theology relating psychology and theological understanding to professional ministry, especially the parish, through course work and supervised clinical or field experience; a concentration in pastoral care through course work and an intern year in basic or advanced clinical pastoral education; a concentration in pastoral counseling through course work and supervised counseling experience in a pastoral counseling center. In the context of clinical pastoral education various professional goals may be sought, including general understanding and skills in pastoral care. The Clinical Pastoral Education Program is certified by the Association for Clinical Pastoral Education. Persons specializing in pastoral counseling and pastoral psychotherapy will be moved toward certification with the American Association of Pastoral Counselors and the American Association of Marriage and Family Therapists. Course PP 181 A (or its equivalent) is considered a prerequisite for a major in pastoral psychology. It is not applicable toward the eight courses required for the degree, although it will be indicated on the student's transcript. Accordingly, the student majoring in this area should ordinarily make provision for a program extending for a full calendar year.

**Financial Aid.** Please note in the pertinent sections of the chapter "Financial Information" that the charges for tuition and general fee for the Th.M. degree are combined and are made on the basis of the number of courses taken, and that in order to be eligible for medical care a student must be taking at least three courses.

**Continuation Requirements.** The following are the continuation requirements for the Th.M. degree program.

1. The student must maintain a cumulative grade point average of 3.0. A student who falls below this level is terminated.
2. The progress of all students is reviewed at the end of every semester by the Academic Standing Committee.

The Th.M. degree must be completed within three years (six semesters). The minimum time in which the degree can be completed is one year (two semesters).

To be classified as full time a student must be enrolled in three or more courses in a semester.

## Duke Summer Session

While the Divinity School does not presently offer a regular summer program, students may enroll for intensive biblical language courses (Hebrew in 1990 and Greek in 1989) or individual directed study. Summer courses of graduate level may also be taken in other departments as cognate credits (maximum of two, see provisions under administration of the curriculum). Permission for such credits must be secured in advance from the instructor and from the associate dean for academic programs, but official registration and payment of fees are handled in the Office of Summer Educational Programs, 120 Allen Building, Duke University, Durham, North Carolina 27706.

## Special Programs

Duke Divinity School is a participant in the National Capital Semester for Seminarians conducted by Wesley Theological Seminary in Washington, D.C. Students may, with the approval of the associate dean for academic programs, enroll in this one-semester program focused on political issues and social ethics, and receive up to four transfer credits. Applicants must have completed at least two and not more than four semesters at Duke to be eligible.

## International Study Programs

For several years the Divinity School has been developing programs of international study and exchange involving faculty and students. The main areas in which the development is centered at this time are the following:

**Mexico Seminar.** Brief intensive travel-study to foster appreciation of Mexico, its people, history, culture, and religion-with special attention to the faith and mission of the church in Latin America today. Direct encounter with Third World poverty. About twelve persons per seminar. Annually.

**China Seminar.** A travel-study seminar on the re-emergence of the Church in China focusing on the unprecedented response to the Church in a Marxist society. Participants have the opportunity also to learn about China and its people and see firsthand the changes taking place in this remarkable country. Biannually.

**Robert E. Cushman Exchange Fellowship.** Each year faculty and staff nominate a student to represent the Divinity School in the Bonn/Duke Exchange program. At Bonn



University (West Germany) the student for a year becomes thoroughly acquainted with another culture and different church life. Full participation in classes at Bonn required. Language preparation necessary.

**Dumfries, Scotland.** In cooperation with St. Michael's Parish, Dumfries, Scotland, the Divinity School offers an academic year's experience. A modest stipend provides basic support and trans-Atlantic air fare. This opportunity is open each year to one rising senior who serves as a full-time parish assistant for this parish of the Church of Scotland.

Students wishing to make other arrangements for study abroad should consult with both associate deans as early as feasible. A more extensive description of the Divinity School's international programs follows the section, "Field Education."

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*Courses of Instruction*



*George M. Marsden, Professor of the History of Christianity in America*

## Course Enrollment

The foundational courses typically carry two digit numbers (e.g., New Testament 18, Church History 13, American Christianity 28, Christian Theology 32). Other courses numbered through 199 are elective courses for Divinity School students only. Most courses numbered 200 and above are approved for credit by both the Divinity School and the Graduate School, and require the permission of the instructor. For other prerequisites the student should consult the roster of courses of instruction in this bulletin and should also refer to published registration advices at the time of registration for each semester.

Courses jointly approved by the Divinity School and the Graduate School of Duke University are published in the *Bulletin of Duke University: The Divinity School*. Courses offered in the Department of Religion of Duke University, or as cognate courses in other departments, must be of graduate level (numbered 200 or above) in order to fulfill requirements for degrees in the Divinity School.

## Projected Course Offerings

The following list of proposed course offerings for the 1989-90 academic year is tentative and subject to change. Detailed listings are available at the time of preregistration in the middle of the preceding semester, and more distant plans may be ascertained by consulting the divisional representative or the instructors concerned.

### Fall Semester, 1989

Old Testament (OT) 11, 115, 163  
New Testament (NT) 18, 103, 114, 117C, 118, 226B  
Church History (CH) 13, 276  
Historical Theology (HT) 337  
American Christianity (AC) 28, 293A  
Christian Theology (CT) 118, 119, 156, 214, 217, 322, 352, 365.35  
Christian Ethics (CHE) 33, 387, 389  
Church's Ministry (CM) 10  
Care of the Parish (CP) 50, 159, 147, 151  
Christian Education (CED) 22, 25  
Church Worship (CW) 178  
Pastoral Psychology (PP) 64, 77, 181-A, 271, 278, 281  
Preaching (PR) 30, 164, 186, 189

### Spring Semester, 1990

Old Testament (OT) 11, 116, 130, 150, 209, 223B, 302

New Testament (NT) 18, 104, 105, 117D, 226C, 340  
Church History (CH) 14  
Historical Theology (HT) 338  
American Christianity (AC) 203  
Christian Theology (CT) 32, 124, 256, 333  
Black Church Studies (BCS) 124  
World Christianity (WC)  
Care of the Parish (CP) 160  
Christian Education (CED) 109, 132, 250  
Christian Worship (CW) 162, 178  
Pastoral Psychology (PP) 181-B  
Preaching (PR) 30, 164

## I. Biblical Studies

### OLD TESTAMENT

**11. Introduction to Old Testament Interpretation.** An introduction to the literature, history, and religion of ancient Israel with emphasis upon exegetical methodology. *Bailey and Crenshaw*

**101. The Prophetic Movement.** A study of the prophetic movement in Israel from the earliest period to the postexilic development of apocalyptic with special reference to the content and religious teaching of the prophetic writings. *Efird*

**106. Exegesis of the English Old Testament.** Prerequisite: OT 11 or equivalent.

106A. Genesis. *Bailey*

106B. Amos and Hosea. *Bailey*

106D. Wisdom Literature in the Old Testament. *Crenshaw*

**106E. Old Testament Psalms.** Exegesis of various literary types; theological orientation of Old Testament liturgical prayer; implications for prayer and liturgy today. *Staff*

**109. The Religion of the Old Testament.** A study of the religious ideas contained in the Old Testament with special reference to their interpretation from Robertson Smith to the present. *Efird*

**115-116. Introduction to Biblical Hebrew.** Elements of phonology, morphology, and syntax. Exercises in reading and writing Hebrew. Exegetical treatment of the book of Jonah. (Two semesters: no credit will be given for 115 without completion of 116.) *Bailey*

**130. Dying and Death.** Critical consideration of biblical, legal, medical, and ethical perspectives. Prerequisites: OT 11, NT 18, or equivalents. *Bailey, H. Smith, and others*

**150. The Interpretation of Scripture** A study of the methods by which modern interpreters seek to understand ancient texts, and of the problems and options involved in the move from text to sermon. Consideration of texts from both Testaments. Evaluation of the Lectionary as a means of interpretation. Prerequisite: OT 11, NT 18. *Bailey, Efird, and others*

**163. Biblical Prayer.** *Crenshaw*

**180. From Text to Sermon.** (See PR 180.) *Staff*

**207. Intermediate Biblical Hebrew I.** Historical Hebrew grammar with reading and exegesis of Old Testament prose (Pentateuch and historical books in alternate years). *Wintermute*

**208. Intermediate Biblical Hebrew II.** Historical Hebrew grammar and rapid reading of prose and poetry. *Meyers*

**209. Old Testament Theology.** Studies of the Old Testament in regard to theological themes and content. Prerequisite: OT 11 or equivalent. *Crenshaw*



**220. Rabbinic Hebrew.** An interpretive study of late Hebrew, with reading from the Mishnah. *Staff*

**223. Exegesis of the Hebrew Old Testament.** Prerequisite OT 115-116.

223A. Amos and Hosea. Stress on hermeneutical method. *Bailey or Crenshaw*

223B. Job. *Crenshaw*

223C. I Samuel. *Bailey*

223D. Song of Songs. *Crenshaw*

223E. Ecclesiastes. *Crenshaw*

223F. Proverbs. *Crenshaw*

223G. Genesis. *Bailey*

**237. History of the Ancient Near East.** Emphasis upon the religions, literature, and art of Mesopotamia. *Bailey*

**242. Life after Death in Semitic Thought.** Consideration of the various ideas from the early second millennium through the Intertestamental Period. Exegesis of selected Old Testament passages. Evaluation of recent research. Prerequisite: OT 11 or equivalent, knowledge of Hebrew helpful but not required. *Bailey*

**302. Studies in the Intertestamental Literature.** Selected documents of the Apocrypha and Pseudepigrapha examined exegetically and theologically in their relation to postexilic Judaism. *Staff*

**304. Aramaic.** A study of the Aramaic portions of the Old Testament and selected passages from the Elephantine and Qumran texts. *Wintermute*

**343. Readings in Ancient Near Eastern Literature.** *Staff*

**350, 351. Seminar in Old Testament.** Research and discussion on selected problems in the Old Testament and related fields. *Staff*

**353. Seminar on Text Criticism.** Emphasis upon transmission, versions, apparatus, and method. Prerequisites: NT 103-104 and OT 115-116 or equivalents. *Bailey and others*

**373-374. Elementary Akkadian.** Study of the elements of Akkadian grammar. Reading of neo-Assyrian texts shedding light on the Old Testament. Prerequisite: biblical Hebrew. (Two semesters: not credited separately.) *Bailey*

**375-376. Elementary Ugaritic.** Study of the elements of Ugaritic. Prerequisite: biblical Hebrew. (Two semesters: not credited separately.) *Staff*

## NEW TESTAMENT

**18. Introduction to New Testament Interpretation.** An introduction to the literature of the New Testament with special attention to the perspectives and methods of historical-critical investigation and interpretation. *Efird, M. Smith, or Via*

**103-104. Hellenistic Greek.** Designed for beginners to enable them to read the Greek New Testament. (Two semesters: no credit will be given for 103 without completion of 104; however, students with at least one full year of college Greek may be permitted to enroll in 104.) *Efird*

**105. Studies in Paul.** An investigation of Paul's apostolate based upon the Acts and the Epistles with attention to Paul's theology as reflected in selected passages. *Efird*

**114. Jesus in the Gospels.** A consideration of the origins, transmissions, and literary fixation of the Jesus traditions with special attention to the message of the Kingdom, the problem of messianic self-consciousness, and the passion. *M. Smith or Via*

**116. Exegesis of the English New Testament I.** *Staff*

- 116A. Luke-Acts
- 116B. Galatians
- 116C. Selected Later Epistles
- 116D. I and II Corinthians
- 116E. Matthew

**117. Exegesis of the English New Testament II.** *Staff*

- 117A. The Gospel and Epistles of John
- 117B. Romans
- 117C. Revelation
- 117D. Mark

**118. The New Testament in Greek.** Readings in the Gospels. *Staff*

**119. The New Testament in Greek.** Readings in the Epistles. *Staff*

**150. The Interpretation of Scripture** A study of the methods by which modern interpreters seek to understand ancient texts, and of the problems and options involved in the move from text to sermon. Consideration of texts from both Testaments. Evaluation of the Lectionary as a means of interpretation. Prerequisite: OT 11, NT 18. *Bailey, Efrid and others*

**180. From Text to Sermon.** (See PR 180.) *Staff*

**2xx. Church and Ministry in the New Testament.** A consideration of the development of the concept and office of ministry in the early church as it is reflected in the New Testament. *M. Smith*

**225. Living Issues in New Testament Theology.** Critical examination of major problems and issues in New Testament interpretation and theology. Prerequisite: NT 18 or equivalent. *M. Smith or Via*

**226. Exegesis of the Greek New Testament I.** Prerequisite: NT 103-104. *M. Smith or Via*

- 226A. Matthew
- 226B. Romans
- 226C. Mark
- 226D. I and II Corinthians
- 226E. The Gospel and Epistles of John

**227. Exegesis of the Greek New Testament II.** Prerequisite: NT 103-104. *M. Smith*

- 227A. Luke
- 227B. Galatians
- 227C. The Pastoral Epistles
- 227D. Acts

**257. New Testament Ethics.** An examination of several approaches to the scope and issues of New Testament ethics, including such topics as symbolic language in ethical discourse, the place of the law, conscience, community, sexuality, and property. *Via*

**309. Hermeneutics.** Consideration of the nature of understanding and of several interpretive methods including phenomenological, existential, historical, literary, and structural. Their application to New Testament texts, primarily the parables of Jesus. *Via*

**311. Pharisaic Judaism in the First Century.** A reading course in first-century Pharisaic Judaism. *Staff*

**312. Pauline Theology.** Studies in some aspects of Paulinism in the light of recent scholarship. *Staff*

**314. Judaism and Christianity in the New Testament.** A study of their interaction with special attention to Paul. *Staff*

**319. The Gospel According to St. Matthew in Recent Research.** *Staff*

340, 341. **Seminar in the New Testament.** Research and discussion on a selected problem in the biblical field. *M. Smith*

345. **The Epistle to the Hebrews in Recent Research.** *Staff*

## II. Historical Studies

### CHURCH HISTORY

13. **Early and Medieval Christianity.** A survey of the history of Christianity from its beginnings through the fifteenth century. *Steinmetz and Keefe*

14. **Modern European Christianity.** A survey of the history of Christianity from the Reformation to the present. *T. Campbell and Steinmetz*

105. **Studies in Patristic Christianity.** Selected issues in the worship, theology, and politics of the early Church. *T. Campbell*

125. **The Evangelical Heritage.** A study of evangelical Christianity from the mid-seventeenth century to the present. *T. Campbell*

126. **The English Reformation.** The religious history of England from the accession of Henry VIII to the death of Elizabeth I. Extensive readings in the English reformers from Tyndale to Hooker. *Steinmetz*

183. **Renewal Movements in Church History.** An investigation of renewal movements as parallel phenomena throughout Christian history utilizing social scientific studies of culture change and focusing on ancient monasticism, Franciscanism, Anabaptism, and early Methodism as representative renewal movements. *T. Campbell*

202. **Religion of the Cappadocian Fathers.** Examination of the careers and writings of Basil, Gregory of Nyssa, and Gregory of Nazianzus. *T. Campbell*

235. **The English Church in the Eighteenth Century.** Studies of Christianity in England from the Act of Toleration, 1689, to the death of John Wesley, 1791. *T. Campbell*

236. **Luther and the Reformation in Germany.** The theology of Martin Luther in the context of competing visions of reform. *Steinmetz*

247-A, B. **Readings in Latin Theological Literature.** Critical translation and study of important theological texts in Latin from various periods of the history of the Church. Prerequisite: reading knowledge of Latin (introductory course offered in the classics department). *Staff*

276. **Baptism in the Patristic and Early Medieval Period.** A study of the celebration and interpretation of the rite of Christian initiation in the church orders and texts of the early church writers. *Keefe*

334. **Theology and Reform in the Later Middle Ages.** Examination of selected issues in the life and thought of the medieval church from the twelfth century through the fifteenth century. Readings in popular and academic theologians from Pierre Abelard to Gabriel Biel. *Steinmetz*

339. **The Radical Reformation.** Protestant movements of dissent in the sixteenth century. Special attention will be devoted to Muntzer, Carlstadt, Hubmaier, Schwenckfeld, Denck, Marpeck, Socinus, and Menno Simons. *Steinmetz*

344. **Zwingli and the Origins of Reformed Theology.** Source studies in the early Reformed tradition. *Steinmetz*

## HISTORICAL THEOLOGY

**114. Christologies of the Early Church.** Investigation of important soteriologies and debates centering upon the person of Christ from the second through the fifth centuries. *T. Campbell*

**123. Readings in Historical Theology.** Prerequisite: CH 13-14. *Staff*

**183. Teachings of the Christian Churches.** An historical examination of Eastern Orthodox, Roman Catholic, Protestant, and evangelical doctrinal statements. *T. Campbell*

**201. Christian Thought in the Middle Ages.** A survey of the history of Christian theology from St. Augustine to the young Martin Luther. *Steinmetz*

**204. Origen.** The systematic and apologetic writings of an important Alexandrian thinker and exegete of the third century. *Staff*

**219. Augustine.** The religion of the Bishop of Hippo in the setting of late antiquity. *Staff*

**241. Problems in Reformation Theology.** Prerequisite: permission of the instructor. *Steinmetz*

**246. Problems in Historical Theology.** Prerequisite: permission of the instructor. *Staff*

**260. Life and Thought of the Wesleys.** A seminar on John and Charles Wesley and their colleagues in relation to English culture and religion in the eighteenth century. Prerequisite: permission of the instructor. *T. Campbell*

**273. Continental and British Roots of Evangelicalism.** A study of seventeenth and eighteenth century movements in Europe and Britain characterized by a stress on personal religious experience. *T. Campbell*

**308. Greek Patristic Texts.** Critical translation and study of selected Greek texts illustrative of significant aspects of patristic theology and history from the second through the fifth century A.D. *Staff*

**313. The Apostolic Fathers.** A study of the religious thought in the writings of the Apostolic Fathers. *Staff*

**317. Seminar in the Greek Apologists.** A study of the apologetic writings of the Greek Fathers in relation to the challenges of their contemporary world. Special attention will be given to leading protagonists of late Graeco-Roman culture, such as Celsus, Porphyry, and Julian. *Staff*

**318. Seminar in the Greek Fathers.** A study of selected topics from the Greek Fathers. *Staff*

**337. Theology of St. Thomas Aquinas.** Intensive reading in the *Summa Theologica* and biblical commentaries. *Steinmetz*

**338. Calvin and the Reformed Tradition.** The theological development of John Calvin. A comprehensive examination of his mature position with constant reference to the theology of the other reformers. *Steinmetz*

## AMERICAN CHRISTIANITY

**28. History of American Christianity.** A consideration of the nature of Christianity in America and the history of its development. *Gilbert and Marsden*

**190. The Protestant Establishment and Secularization in Modern America.** Exploration of Protestant contribution to the secularization of America since 1865 and of the ways in which Protestantism itself has become secularized. *Marsden*



**203. Studies in American Methodism.** Research seminar devoted to selected topics in the Wesleyan and Methodist traditions in America. *Richey*

**267. American Puritan Thought through Edwards.** A seminar built around some of the classic studies of American Puritan thought, culminating with a more intensive look at literature by and about Jonathan Edwards. *Marsden*

**270. American Evangelicalism and Fundamentalism.** A reading seminar covering major themes in the development of transdenominational evangelicalism and fundamentalism in America from the eighteenth century to the present. *Marsden*

**293. Religious Issues in American History.** A reading seminar devoted to selected topics, problems and issues in American religion. *Richey or Marsden*

**295. Religion in the American South.** A study of the interrelationships of southern religion and southern culture. *Marsden*

**342. American Religious Biography.** A study of the leading biographers of American religious figures and of the qualities of a successful biography. *T. Campbell*

**397. Issues in American Theology.** A critical appraisal of major tendencies. *Staff*

## HISTORY OF RELIGIONS

**180. Introduction to Asian Religions.** Preliminary consideration of problems and methods in the study of religious traditions, followed by a survey of the historical development, beliefs, practices, and contemporary significance of the Islamic religion and the religions of India, China, and Japan. *Staff (Department of Religion)*

*See other courses offered in the Department of Religion.*

## III. Theological Studies

### CHRISTIAN THEOLOGY

**32. Christian Theology.** The course aims at furthering the active appropriation of the Christian faith in the context of the contemporary church and in engagement with the world of today. It treats principally the themes of the classic creeds or the traditional topics of dogmatics. It also introduces students to the epistemological issues of revelation, faith, authority, interpretation, and social location. *Staff*

**102. Science and Biblical Theism.** Implications of scientific knowledge in relation to biblical understandings of creation, revelation, and providence. *Staff*

**105. A Theological Introduction to Roman Catholicism.** An exploration of fundamental themes of Roman Catholic history, theology, liturgy and spirituality, with special attention to the mass. *Berger*

**108. Major Types of Protestant Theology.** A survey of Protestant theology from the reformers to Karl Barth. (For juniors only.) *Herzog or Langford*

**110. This Life and the Age to Come.** Christian eschatology and the meaning of history in the light of God's triumph over sin, suffering, and death. *Staff*

**112. The Doctrine of the Holy Spirit.** An examination of pneumatology under systematic categories which include: creation, Old Testament, prophecy, the life and ministry of Christ, the Church, salvation, the canon, the sacraments, and eschatology. *Turner*

**118. Theological Controversies from Schleiermacher to Barth.** Examination of major figures and theological issues of nineteenth-century Protestant theology. Attention to the relation of faith and culture, the role of experience in theological reflection, religion as illusion, the Jesus of history and the Christ of faith. *Fulkerson*

119. **Prayer and Contemplation.** *Herzog*

124. **Issues in the Wesleyan Theological Tradition.** A study of selected historical and constructive themes. Specification of topics will be made at each time of offering. *Langford*

134. **Theology of Pentecostalism.** An exploration of this tradition with examination of its distinctive emphases and interpretations of Christian faith. *Turner*

133. **The Task of the Theologian.** An introduction to the nature and task of theology as part of the life of the church. *Berger*

139. **Women, Theology and the Church.** *Fulkerson*

149. **Images of the Church.** Selected theologies of the nature of the church from the reformation to present. *Fulkerson*

200. **The Person and Work of Christ.** The problem of knowledge of Christ and formulation of a doctrine of His work and person in the light of biblical eschatology. *Staff*

210. **Contemporary British Theology.** Selected problems in representative British theological writings after 1900. *Langford*

211. **Authority in Theology.** The idea and function of authority in theology. *Langford or Fulkerson*

214. **Feminist Theology.** Examination of feminist theologians and religionists, their critical perspective on the Christian tradition and constructive proposals out of the resources of "female experience." *Fulkerson*

215. **The Nature and Mission of the Church.** Christian understanding of the Church—biblical, historical, contemporary—with a view toward ecumenical doctrinal construction. *Herzog*

216. **Kierkegaard Studies.** Critical examination of selected works. *Staff*

217. **Church and Sacraments.** The basic teachings on church and sacraments, biblical, historical, contemporary. *Herzog*

220. **Theological Explorations.** A seminar on contemporary theological issues, content to be designated by the theological division. *Staff*

222. **Contemporary Pneumatologies.** An exploration of the doctrine of the Holy Spirit in relation to modern trends in theology with special emphasis on those cases where there is an accompanying social movement. *Turner*

225. **The Christian Understanding of Human Nature and Destiny.** Representative historical and recent theological interpretations of human nature, predicament, deliverance, and possibility. *Staff*

229. **Tragedy and Christian Faith.** An analytical and constructive philosophical interpretation of the fundamental tragic dimension of human life in the light of a Christian theological understanding. *Staff*

249. **The Lord's Prayer.** By studying historic and contemporary expositions of the Lord's Prayer, this course provides an introduction not only to the doctrines of God, humanity, prayer, and the kingdom, but also to the variety of the Christian spiritual tradition in time and space. *Wainwright*

256. **John Wesley in Controversial and Ecumenical Theology.** A study of John Wesley and his theology both in his engagements with other confessional traditions, and in his views on such matters as church, ministry, sacraments, and authority. Consideration will also be given to these topics in relation to contemporary theology, especially "Faith and Order." *Wainwright*

- 259. Icon Theology.** A study of theological controversies surrounding the use of images in Christian worship, followed by an attempt to perceive the symbolic conventions and doctrinal content of some Eastern, Western, and contemporary icons. *Wainwright*
- 272. Theology of Paul Tillich.** An examination of Tillich's philosophical theology. *Staff*
- 279. Understandings of the Resurrection in Contemporary Theology.** A study of recent literature on the resurrection of Jesus Christ from the angles of exegesis, historical criticism, hermeneutics, and systematic significance. *Wainwright*
- 299. Theology and Contemporary Secular Understandings of Human Nature.** Critical theological examination of selected current interpretations of human nature and the human situation. *Langford*
- 300. Systematic Theology.** Method and structure of systematic theology, the doctrine of God, theological anthropology, and Christology. Prerequisite: CT 32 or equivalent. *Herzog or Langford*
- 303. Philosophical Method in Religious Studies.** European hermeneutic (Gadamer) and American process philosophy (Whitehead and Hartshorne) as applied to Christian theology. *Herzog*
- 320. Theology, Power, and Justice.** Critical examination of a major theme of modern thought in Schleiermacher, Hegel, Marx, and Tillich. *Herzog*
- 322. Nineteenth-Century European Theology.** Protestant theology from Kant to Herrmann. *Herzog*
- 325. Philosophical Theology I.** Selected readings from Plato and Aristotle which helped to shape philosophical theology from Origen through Augustine and Aquinas. *Herzog*
- 326. Philosophical Theology II.** Main problems of philosophical theology in the modern period. *Staff*
- 328. Twentieth-Century European Theology.** Critical examination of the thought of selected Protestant theologians from 1900 to 1950. Prerequisite: CT 32. *Herzog*
- 329. Readings in Theology and Language.** Sample treatments of religious language in linguistic analysis, hermeneutical theory, literary criticism, liturgical practice, and fundamental theology. *Wainwright*
- 330. Contemporary Christologies.** A seminar dealing with contemporary Roman Catholic and Protestant Christology. Readings and discussion will focus on theological proposals from major contemporary figures. *Wainwright*
- 331. Eschatology.** A study of issues in individual, communal, and universal eschatology against the background of twentieth-century scholarly work in the kingdom of God. *Wainwright*
- 332. System in Theology.** An examination of the various factors that go into the shaping of a systematic theology, followed by a study of several recent and contemporary examples of the genre. *Wainwright*
- 333. Systematic Theology: The Doctrine of the Trinity.** Biblical bases, patristic developments, contemporary statements and connections. *Wainwright*
- 352. Seminar in Christian Theology.** Research and discussion of a selected problem in the systematic field. *Staff*

## CHRISTIAN ETHICS

**33. Christian Ethics.** The course tackles theological and conceptual issues that deal with the ways in which Christian moral discourse is generated in the life of the Church, in order that students may gain a sense of basic methodological alternatives in Christian traditions. It introduces students to such matters as the Church's relationship to the world, casuistry of various kinds, character formation, a moral psychology necessary for the development of Christian virtue, the place and function of scripture, and how Christians understand social responsibility. *Staff*

**107. The Biblical Bases of Christian Ethics.** Examination of major themes and moral teachings, principally in the Decalogue, the Gospels, and the Epistles, with application to some contemporary issues. Prerequisite: OT 11, NT 18, or equivalent. *H. Smith*

**112. Technology and Christian Ethics.** The impact of the technological revolution upon American culture, and a normative Christian response. *Staff*

**113. Contemporary Issues in Christian Morals.** Constructive examination of selected areas of public and private morality. *Staff*

**130. Dying and Death.** Critical consideration of biblical, legal, medical, and ethical perspectives. Prerequisites: OT 11, NT 18, or equivalents. *Bailey, H. Smith, and others*

**136. Perspectives on Food and Hunger.** An interdisciplinary symposium on national and world hunger and malnutrition, including (whenever possible) student involvement in local hunger-related agencies. *Staff*

**194. The Protestant Church and American Culture.** Analysis from the perspective of Christian ethics of current problems in the interpretation of church and culture with explicit reference to the parish setting. *H. Smith*

**205. War in the Christian Tradition.** An analysis of how Christians have understood and evaluated war. Particular attention to the question of whether war should not be regarded as a positive moral good. Works by Augustine, Aquinas, Bainton, Ramsey, Childress, Niebuhr, and Johnson will be considered. *Hauerwas*

**213. Christian Ethics in America.** *Hauerwas*

**215. Seminar in Theological Ethics.** Seminar that concentrates on readings in Aristotle, Aquinas, Kant, and Barth. *Hauerwas*

**220. Ethical Explorations.** A seminar on contemporary ethical issues, the specific content in any given semester to be designated by the Theological Division. *Staff*

**230. Moral and Value Education.** A critical, theological investigation of Durkheim, Dewey, Simon, Kohlberg, Bull, Rokeach, and implications for education in church and society. Prerequisites: CHE 33 and CED 105. *H. Smith and Westerhoff*

**242. Human Sexuality.** Examination of biological, biblical, cultural, and other aspects of human sexuality, together with analytical and constructive interpretation. Permission of instructor required. *H. Smith*

**244. Interdisciplinary Seminar in Medical-Legal-Ethical Issues.** A seminar composed of students and faculty from the Medical, Law, and Divinity Schools for critical consideration of selected pertinent issues of mutual professional interest. Prerequisite: permission of instructor. *H. Smith and others*

**245. Ethics in World Religions.** Moral foundations, assumptions, and applications in such historic faiths as Hinduism, Buddhism, Confucianism, and Islam, in the light of Christian ethical perspectives. *Staff*



**262. Marxist Ideology and Christian Faith.** Comparative examination of Communist and Christian doctrines such as man, society, sin, history and eschatology, together with an introduction to the contemporary dialogue. *Staff*

**266. Ethics and Health Care.** Critical examination of philosophical and theological bases of medical practice, and analysis of selected aspects of biomedical technologies, with particular attention to informing ethical assumptions. *H. Smith*

**268. Revelation and Authority in the Church.** A critical and constructive examination of contemporary concepts, exploring such questions as "Is the Church's memory autonomous or constituted and directed by what it remembers? How does ecclesiology shape epistemology, and vice-versa? Does the word of the Church also become the mission of the Church? Is the word of God constitutive of human community?" *H. Smith*

**290. Current Problems in Christian Social Ethics.** A critical study of secularization, the technological revolution, and the ecological crisis. *Staff*

**291. Historical Forms of Protestant Ethics.** A survey of major types of Protestant ethical theory from Luther through contemporary figures. *Staff*

**292. Happiness, the Life of Virtue, and Friendship.** An investigation of the interrelation of these themes in selected authors. An examination of whether the loss of the interrelation of these themes accounts for some of the problems of modern philosophical and theological ethics. *Hauerwas*

**294. Christianity and the State.** "Civil religion" in its historic development and contemporary expressions in America. Christian ethical premises of democratic political theory and practice. The relationships of church and state. *Staff*

**383. Moral Theology in the Twentieth Century.** Critical and comparative examination of ethical theory as exhibited in the work of selected contemporary theologians. *H. Smith*

**387. Ethical Method.** Selected methodological issues in contemporary theological ethics. *H. Smith*

**389. Christian Ethics and Contemporary Culture.** A study of the interaction between Christian thought and current secular social theory. *Staff*

## **BLACK CHURCH STUDIES**

**100. Introduction to Black Theology.** An examination of the historical roots of black theology with special attention to the treatments of traditional themes and problems in theology by black theologians and their rationale for the black theological enterprise. *Turner*

**124. The Black Church in America.** A consideration of the historical and theological development of the separate black Christian denominations in America with attention to some of the major leaders, black worship, and black preaching. *Turner*

**126. Black Religion and Social Conflicts in America.** An examination of some of the reactions of black religious groups to the limits placed upon black people in American life, efforts made to break down racial barriers in society, and attempts to institutionalize black responses to such barriers. *Turner*

**128. The Life and Thought of Martin Luther King, Jr.** An examination of the life of Martin Luther King, Jr., as a minister and leader of the civil rights movement. *Staff*

**144. Selected Topics in Black Church History.** An exploration of pivotal events, key issues, and persons in the development of the black church in America. Prerequisite: BCS 124 or permission of the instructor. *Staff*



*Carol M. Noren, Assistant Professor of Homiletics*

## WORLD CHRISTIANITY AND ECUMENICS

**124. The Christian World Mission.** A study of theological foundations, guiding principles, and contemporary problems of the world Christian community. *Staff*

**129. Ecumenical Visions of the Church in the Twentieth Century.** A study of some of the major theologies of the Church in our century, as they emerged together with the growth of the ecumenical movement. The course will focus on how specific ecclesologies treat the question of the unity of the Church(es) in the light of ecumenical hopes, proposals for unity and practical endeavors. *Berger*

**133. The Expansion of Christianity.** A survey of the spread of Christianity and the growth of the worldwide Church with special emphasis on nineteenth- and twentieth-century Protestantism in the non-Western world. *Staff*

**135. Contemporary Issues in the World Church.** Analysis of political, social, cultural, and religious conditions in a selected area of the world, and of theological-ethical insights and perspectives within the indigenous Christian community. *Staff*

**156. The Ecumenical Movement.** Its contemporary development, structures, activities, and problems, against the background of Church unity and disunity. *Staff*

**263. Third World Theology.** An examination of selected theological writings from Asia, Africa, and Latin America, comparing their perspectives and their unique contributions with contemporary Christian thought. *Staff*

**386. Christianity in Dialogue with Other Faiths.** Contemporary currents of Christian thought as they relate to resurgent non-Christian religions and involve new formulations of a theology of mission. *Staff*

## IV. Ministerial Studies

### THE CHURCH'S MINISTRY

**10.** A general and integrated introduction to critical reflection on the history, theology, and practice of ordained ministry in Christian communities. Required of entering M.Div. students. *Staff*

**100.** A sequel course, accenting the practice of ministry, to be taken after a M.Div. student has completed fifteen courses. *Staff*

### THE CARE OF THE PARISH

**50. Church and Community.** The structure and dynamic factors shaping the present-day community together with their import for the work of the Church. *Wilson*

**128. Ministerial Leadership and Participative Skills.** A study of the pastor's role as participant-facilitator with attention to organizational theory and facilitative skills employing the group workshop method of learning. *Staff*

**129. The Pastor as Consultant to Church Organizations.** A consideration of the pastor's role as organizational consultant with special emphasis on data gathering, diagnosis, and intervention using experiential learning designs. *Staff*

**130. Planning and Directing the Church's Program.** Principles of planning, organizing, staffing, directing, and evaluating the program of the local church. *Staff*

**142. Women and Ministry.** Theological and practical issues related to women and ministry. *Staff*

**147. The Pastoral Responsibility for Administration.** A consideration of the major responsibilities of the pastor in the administration of the local church. *Staff*

**148. Christian Stewardship and Church Finance.** A seminar to consider the principles of stewardship, education, budget-making, enlistment in church support and church financial management in theological perspective. *Staff*

**151. The Town and Country Church.** The small church, the circuit church, circuit administration, larger parish and group ministry, and the town and country movement. *Wilson*

**152. Evangelism as a Pastoral Concern.** A study of the nature, purposes, and methods of contemporary Christian evangelism with special attention to the local church. *Staff*

**154. The Urban Church.** The function, nature, program, and administration of the effective city church and of the urban minister's distinctive task. *Wilson*

**155. Church Polity.**

**155B. The Baptist Churches**

**155C. The United Church of Christ**

**155D. The Presbyterian Churches**

**155E. The Christian Church (Disciples of Christ)**

**155F. The Episcopal Church**

**157. The Church and Social Change.** A sociological study of the relationship of the Church to the process of social change, including the role of the Church as innovator, the Church as participant in social movements, method(s) of accomplishing change, and the religious leader as an agent of social change. *Wilson*

**158. Contemporary Religious Sects.** The nature, ideology, development, clientele, and role of contemporary religious sects; the process by which such sects develop into established organizations; and their relationship to the mainline churches. *Wilson*

**159. Early Methodism: History, Theology, and Polity.** A study of the character and development of Methodism, beginning with John Wesley and tracing important features of this tradition through the nineteenth century. *D. Campbell, Goodson, and Wilson*

**160. Twentieth-Century Methodism: History, Theology, and Polity.** The development of the United Methodist Church, focusing on theological diversity and patterns of organizational life, with major concentration on the polity of this church as provided by the current Discipline. *D. Campbell, Goodson, and Wilson*

**189. The Multiple Staff Ministry.** Group work, leadership, and organizational theories as applied to staff ministries in large church and cooperative parish settings. *Staff*

**200. Church Research.** Methods of research and survey for the gathering, analysis, and interpretation of church and community data, together with preparation and use of denominational statistics. *Wilson*

**220. Seminar in Contemporary Ministries.** A seminar in patterns and issues of contemporary ministries, content to be designated by the Ministerial Division. *Staff*

## CHRISTIAN EDUCATION

**22. The Spiritual Life.** An introduction to spirituality, spiritual formation, and the development of a personal spiritual discipline. *Westerhoff*

**25. Education as a Pastoral Ministry.** An introduction to Christian formation, education, and instruction within the life of a worshipping faith community. *Westerhoff*

**102. Christian Education and the Small Membership Church.** An overview of the educational ministry of churches with small memberships including goal setting, program-format, leadership development, selection of curriculum resources, organization-design, and evaluation methodology. *Staff*



**109. Ministries with Youth.** An experimental approach to inventing strategies for church educational ministries with junior highs, senior highs, and older youth. Attention will be given to teaching methods, curriculum resources, confirmation, and various teaching settings. *Staff*

**110. Educational Ministries with Adults and Families.** An introductory course to the educational ministry of the church with adults and families. Guidance and resources toward the development of comprehensive programing. Attention will be given to adult ages and stages and family life cycles. *Staff*

**112. Educational Ministries with Children and Youth.** An introductory course to the educational ministry of the Church with children and youth. It will consider foundations, religious development theories, goal-setting, teaching-learning, curricula, and leadership education. *Staff*

**132. Curriculum, Teaching, and Learning in Christian Education.** An introductory survey of teaching-learning theory, principles and practices, curriculum designs and resources, from a local church perspective. *Staff*

**153. Education and Social Issues.** An exploration of contemporary social issues and their relationship to education and to the Church. *Staff*

**185. The Arts and the Church.** An exploration of the intuitive way of knowing and the place of the imagination in Christian faith and life with special attention to the use of the arts in the Church, in Christian education, and in worship. *Westerhoff*

**190. The Church's Teaching Office.** An applied course in the teaching/learning process, along with models, strategies, and methods for teaching adults, including instructional preaching. *Westerhoff*

**220. Colloquium in Religious Education.** *Staff*

**233. Pastoral Spirituality.** An introduction to spiritual direction, the spirituality of healing and reconciliation, and spiritual formation. Prerequisites: CED 22 and permission of the instructor. *Westerhoff*

**250. M.R.E. Senior Symposium.** This course will deal with the theory and practice of educational leadership in the Church and will include the following: Field Education seminar, professional competence evaluation, and comprehensive examination. *Westerhoff*

**269. Major Issues in Christian Education.** Critical examination of selected theological and historical issues in Christian education. *Staff*

## PASTORAL PSYCHOLOGY

**64. Pastoral Counseling in a Parish Setting.** The local church as the setting for pastoral counseling. Lectures, group supervision, and student verbatim materials will be utilized. Prerequisite: currently placed in a field setting or permission of instructor. *Mickey*

**77. Pastoral Care in the General Hospital Setting.** An examination through intensive individual and group supervision, of the student's pastoral ministry to the ill, the dying, and the bereaved in the general hospital setting. (Not recommended for those planning to take PP 181 or 182.) *Staff*

**171. Pastoral Counseling.** Consideration of the structures and processes of pastoral counseling; pastoral evaluation, referral, intake contract, goals, transference, termination, and other special problems. Prerequisite: permission of instructor. *Staff*

**172. Premarital Counseling.** Pastoral care in marriage and family life with special emphasis on premarital guidance within the context of the local church's program of family life education. *Staff*

**173. Psychotherapy and Sanctification.** An analysis of structuring and growth processes in psychotherapy in the light of a Christian understanding of sanctification. *Mickey*

**174. Theology and Personality Processes.** Theological and psychological understandings of basic human experiences; explorations of the dynamics and values of religious practices, developmental concerns, self awareness. *Mickey*

**175. Special Practicum Projects.** For advanced students who want additional clinical experience under supervision in a pastoral care setting (inner-city; alcoholic rehabilitation; counseling; etc.). *Staff*

**176. Pastoral Care and Persons in Institutions.**

**176B.** Lectures by staff and ward visits at the Murdoch Center for the Mentally Retarded and the facilities in the Butner, North Carolina, complex (state hospital, alcoholic rehabilitation, training school). *Staff*

**176C.** Lectures by staff and ward visits at the Central Prison in Raleigh and related correctional facilities. *Staff*

**176D.** The Church's ministry to the elderly and home bound explored through lectures, case conferences, and visits to the elderly and homebound parishioners of local Durham churches. *Staff*

**178. Power and Restraint in the Parish.** Exploring the nature of power and leadership in developing skills for local church ministry, utilizing theological, psychological, sociological insights. Verbatim materials. *Mickey*

**180. Pastoral Care and Women.** Lecture-discussions by staff and visiting professionals to aid in developing skill in the pastoral care of women. Issues addressed: moral development, sexual dynamics, dual career families, child and spouse abuse, women in leadership positions. *Mickey*

**181-A, B. Basic Clinical Pastoral Education, Extended.** A semester long unit of CPE in the fall semester and a semester long unit of CPE in the spring semester. The program is accredited by ACPE and is conducted at Duke Hospital. The maximum credit is two course credits. *Staff*

**182-A, B, C. Basic Clinical Pastoral Education.** Units of Basic CPE offered in the summer, fall, and spring in programs accredited by ACPE. (Two course units each, maximum credit.) *Staff*

**183. Pastoral Care: Individual and Community.** A seminar examining the practice of pastoral care. Focus on assessment and intervention by the counseling pastor in critical human situations. *Meador*

**271. Marriage and Family.** The psychodynamics of marital conflict and family problems; principles and procedures in marriage and family counseling. (For seniors and Th.M. candidates.) *Staff*

**273. Seminar in Pastoral Theology: Theological Dimensions of Pastoral Counseling.** Research and discussion of issues of developmental psychology and spiritual growth. *Mickey*

**275. Individual Study in Pastoral Psychology.** Selected readings in major issues in pastoral psychology issuing in a research or honors paper. *Staff*

**278. Psychological Theories of Personality.** A systematic presentation of leading personality theories, with reference to developmental processes (motivation, cognition, learning, etc.) and their implications for Christian ministry. *Mickey*

**281-A, B, C. Advanced Clinical Pastoral Education in Pastoral Care and Counseling.** Pastoral care with inpatients and pastoral counseling of individuals, couples, families, and groups in a pastoral counseling center. (Two course units each.) *Staff*

## PREACHING

**20. Communication Lab.** A workshop on principles of speech and effective oral communication, making extensive use of audio-visual resources and private conferences. To be taken concurrently with PR 30. *Staff*

**30. Theology and Practice of Preaching.** The development of a theology of preaching and methods of sermon construction, including preaching in class, critique, private conference, and local church evaluation. Prerequisite: OT 11 or NT 18 or permission of instructor. *Lischer and Noren*

**161. Preaching and the Church Year.** Preaching the lectionary texts in the context of the Church's worship and calendar. The appropriate cycle of the lectionary will be followed. In-class preaching and evaluation. Prerequisite: PR 30 *Lischer and Noren*

**162. The Rhetoric of Preaching.** Preaching and the art of language. A survey of rhetorical theories, forms, and techniques in service to the Gospel. In-class exercises, preaching and evaluation. Prerequisite: PR 30. *Lischer*

**164. Proclaiming the Parables.** Approaches to the interpretation and proclamation of the parables of Jesus. Readings in nonbiblical narrative and parable. In-class storytelling and preaching. Prerequisite PR 30. *Lischer*

**165. Preaching as Public Address.** A workshop on preaching and worship leadership organized around the principles of speech and effective communication. Extensive use of audio-visual recordings and private conferences. Prerequisite: 30. *Staff*

**180. From Text to Sermon.** Preaching from Biblical sources. Emphases upon the goal and methodology of exegesis, the hermeneutic problem, and verbal communication in the present. Prerequisite: PR 30. *Staff*

**182. Preaching Practicum.** An advanced laboratory course for extra competence in the preparation, delivery, and evaluation of sermons. Prerequisite: PR 30. *Lischer and Noren*

**183. Preaching in the Black Community.** A study of the style and content of black preaching with attention to the unique roles of black preachers in society. An analysis of the essential characteristic of preaching in the black church. Prerequisite: PR 30. *Turner*

**184. Preaching in the Wesleyan Theological Tradition.** A study of selected major themes in Wesleyan theology and their interpretation in contemporary preaching. Prerequisite: PR 30. *Noren*

**186. Twentieth-Century Preaching.** A study of contemporary preaching based on printed, recorded, audio- and video-taped sermons of leading homiletics of our age. Prerequisite: PR 30. *Noren*

**189. Preaching in Context.** *Prerequisite: PR 30. Turner*

**196. Preaching in the Parish.** A consideration of preaching in relationship to pastoral duties and the total task of ministry with attention to week-by-week preaching in the parish setting. Some attention will be given to funerals and crisis situations. Prerequisite: PR 30. *Staff*

**280. History of Preaching.** A study of theological trends and significant personalities in homiletics in various periods from the Apostolic Age to the present. Prerequisite: PR 30. *Noren*

**281. Advanced Sermon Analysis Seminar.** A critical study, on the basis of selected sermons and student presentations, of principal and practical problems facing the contemporary preacher. Prerequisite: PR 30. *Lischer or Noren*

**282. Women and the Word.** An examination of theological, social, historical, and communication issues pertaining to women and preaching. Sermons, video-tapes and other resources will be used in analyzing the styles and content of preaching by women representing various traditions and historical periods. Prerequisite: PR 30. *Noren*

**283. Theories of Preaching.** Significant theories of preaching from Augustine to the present. Seminar presentations and in-class preaching and valuation. Prerequisite: PR 30 or permission of instructor. *Lischer*

## WORSHIP AND CHURCH MUSIC

**123. Baptism, Confirmation, and Renewal.** Biblical, historical, and theological perspectives on the sacrament of Christian initiation. Issues related to the catechuminate, baptismal practice, confirmation, and rites of renewal will be examined with reference to the reform of the liturgy. *Staff*

**141. The Church Year.** An historical and practical study of the church year and lectionary with major attention to the ecumenical and United Methodist calendar. *Staff*

**153. The Leadership of Worship.** A practicum utilizing a laboratory setting devoted to the development of styles of liturgical leadership appropriate to pastoral ministry. *Staff*

**162. Hymnody.** A survey of hymns, various hymn types and styles, and issues in hymnody designed for persons in or preparing for Christian ministry. Includes an introduction to the fundamentals of hymnology. *Arcus*

**167. Baptism and the Lord's Supper.** Study of these sacraments with attention given to major representative traditions and to varieties of present observance and practice. *Staff*

**168. Worship in the Wesleyan Tradition.** The history, development, and current trends in United Methodist worship along with practical experience and concerns related to worship leadership in United Methodist churches. *Staff*

**178. Christian Worship.** A survey of the history of Christian corporate worship. Examination of the major biblical, historical, and theological developments in worship from Old Testament times to the present. Readings in liturgical thought through the ages with comparative study of selected liturgical traditions. *Staff*

**180. Church Music.** A two-fold study including: (1) a survey of the great monuments of church music; (2) musicianship, song-leading, and basic conducting with an emphasis upon the selection and use of hymns and other music from the *Methodist Hymnal* in public worship. *Staff*

**203. Directed Reading in Church Music.** An advanced course offering students the opportunity to explore an area of church music of special interest to them, culminating in a major paper and/or public presentation. Includes compilation of bibliography for the study of church music. Enrollment limit: ten. Prerequisite: consent of instructor. *Arcus*

**220. Selected Topics.** *Staff*

**250. Advanced Seminar in Liturgical Studies.** Reading and research in a selected area of liturgical study to be announced. *Staff*

**251. Studies in Spirituality.** A consideration of different dimensions of the spiritual life. *Staff*



## SPIRITUALITY

See the respective division listings for course descriptions.

**OT 163. Biblical Prayer.** *Crenshaw.*

**CH 125. The Evangelical Heritage.** *T. Campbell.*

**CT 112. The Doctrine of the Holy Spirit.** *Turner.*

**CT 119. Prayer and Contemplation.** *Herzog.*

**CT 249. The Lord's Prayer.** *Wainwright.*

**CED 22. The Spiritual Life.** *Westerhoff.*

**CED 233. Spiritual Direction.** *Westerhoff.*

**CW 251. Studies in Spirituality.** *Staff.*

## V. Clinical Training and Internships

### CLINICAL TRAINING IN PASTORAL PSYCHOLOGY

Students may earn up to two course credits for a quarter or unit of clinical pastoral education in programs accredited by the Association for Clinical Pastoral Education (ACPE).

Students involved in clinical training under the direct supervision of members of the pastoral psychology staff during the academic year should register for credit under PP 182 for two course units unless a course credit has already been received for PP 77, in which case only one rather than two credits will be granted for the CPE quarter. Students should apply for such training through the Director of Clinical Pastoral Education.

Students involved in clinical training in summer CPE quarters should register with ACPE and the Associate Dean for Academic Programs as soon as accepted for training by a chaplain supervisor. Upon the receipt of a supervisor's report at the end of the training period the student will receive two course units of transfer credit.

### INTERNSHIPS

In consultation with the associate dean for field education and the associate dean for academic programs, an individually designed internship may be developed in a particular ministerial vocational area of interest. Under certain circumstances it may be possible to earn one unit of field education and two course credits through such internships. Such programs must be formulated and recorded in advance in the offices of both field education and curricular affairs.

**125-126. Special Ministry Internship.** When a student needs to develop professional competencies in a highly specialized form of ministry, the associate dean for field education will assist in designing an appropriate learning contract and in negotiating for a suitable placement setting, provided the arrangements meet the basic criteria approved by the Field Education Committee.

**131-132. Ministry through Social Agency Internship.** A twelve-month placement in a regular personnel position in a social service agency to meet the job description of the agency and to develop a personal mode and style of ministry in a secular setting through understanding, appreciation, involvement in, and critical theological reflection upon environment, structures, values, and decision-making processes as conveyed by the conduct of the agency.

**137-138. Parish Ministry Internship.** A twelve-month placement, individually designed to engage the student in specified learnings in a wide variety of ministry func-

tions in a local parish, under qualified supervision and using the guidelines of a learning contract.

**143-144. Campus Ministry Internship.** A nine- to twelve-month placement in approved locations designed to provide special learnings in delivering a ministry to college students under qualified guidance and utilizing a learning contract which specifies seminars, a personal journal, directed reading, and consultations to develop competency in these functions.

**175-176. Clinical Pastoral Education Internship.** A twelve-month placement in a clinical program accredited by the Association for Clinical Pastoral Education (ACPE).

**197-198. Mission Internship.** A special internship to prepare for service in church missions may be arranged by enlisting in the national or overseas program of the United Methodist Board of Global Ministries for one to three years. As a requirement for agency planning, applications should be initiated in the fall of the middler year. Other denominational and/or work-study experiences abroad may be given field education credit by special arrangement with the associate dean for field education.

## Department of Religion—Graduate Courses

The following courses are offered periodically in the Graduate Department of Religion by Department of Religion faculty and may be taken by Divinity students with permission of the instructor.

- 217. Islam in India
- 219. Augustine
- 221. Reading in Hebrew Biblical Commentaries
- 230. The Meaning of Religious Language
- 231. Seminar in Christianity and Contemporary Thought
- 233. Modern Narrative and Religious Language
- 243. The Archaeology of Palestine in Biblical Times
- 244. The Archaeology of Palestine in Hellenistic-Roman Times
- 248. The Theology of Karl Barth
- 252. Nineteenth- and Twentieth-Century Roman Catholic Theology
- 254. Introduction to African Religions
- 255. Seminar in African Religions
- 258. Coptic
- 264. The Sociology of the Black Church
- 265. The Religions of the West Africa Diaspora
- 280. The History of Religions
- 281. Phenomenology and Religion
- 284. The Religion and History of Islam
- 301. Seminar in Contemporary Christian Ethics
- 302. Studies in Intertestamental Literature
- 304. Aramaic
- 304A. Targumic Aramaic
- 306. Language and Literature of the Dead Sea Scrolls
- 310. Readings in Judaica
- 323. A-B. Comparative Semitic I-II
- 324. Readings in the History of Religion
- 360. Special Problems in Religion and Culture
- 370. Seminar in Religion and Literature
- 380. Existentialist Thought



## Appendix

### GUIDELINES FOR INCLUSIVE LANGUAGE

#### Duke Divinity School

. . . the decadence of our language is probably curable. Those who deny this would argue, if they produced an argument at all, that language merely reflects existing social conditions, and that we cannot influence its development by any direct tinkering with words and constructions. So far as the general tone or spirit of language goes, this may be true, but it is not true in detail. Silly words and expressions have often disappeared, not through any evolutionary process but owing to the conscious action of a minority.

George Orwell

*Politics of the English Language*

The necessity for change is the parent of tradition. If we want a change in our language to come, we must first facilitate that change through concerted action. Our language is determined both by who we are as individuals and communities and who we want to become.

The affirmation of the integrity of people with various opinions and interpretations on the issue of language is assumed. It is recognized, however, that exclusive language can work unwitting and unintended harm by distorting reality and excluding members from our community. Therefore, all members of this Duke Divinity School community (students, faculty, administrators, and staff) are invited to join together in using language which most adequately reflects the unity of the people of God and the reality of God.

### LANGUAGE ABOUT PERSONS

#### I. Generic Usage

Although "man" originally carried the meaning of both "human beings" and "adult males," such can no longer be assumed. Even though technically "man" is inclusive, its actual use is often exclusive.

- A. Use precise language. When in the past you would have been inclined to use the generic term "man," find creative ways to use such words as "humankind, humans, persons, everyone, men and women, children of God, etc."
- B. Use words that do not include "man" when referring to occupations and positions that can include both males and females. Alternative descriptions can often be found which are not awkward compounds:

<i>(instead of)</i>	<i>(try)</i>
Clergyperson	Clergy
Chairperson	Chair
Congressperson	Representative
Policeman	Police Officer
Fireman	Fire Fighter
Chairperson	Moderator, Presiding Officer, Convenor



## II. Pronoun Usage

Pronoun usage which avoids gender specific categories is an effective way to include all members of society or a given community in general references. While English grammars generally maintain that the nonspecific individual be referred to as "he," such a reference is not inclusive. One should attempt to make all pronoun references inclusive.

- A. When speaking in general terms or when referring to both women and men, use pronouns so as to make explicit that both men and women are included. This may be accomplished by using such methods as "he and she," "hers and his," or combinations such as "he/she," "s/he," and "his/hers."
- B. Other approaches to the pronoun issue include:
  1. Use writing that reduces unnecessary or excessive gender specific pronouns: "The average American drives his car to work" can become "The average American drives to work."
  2. Rephrase statements into the plural: "Most Americans drive their cars to work."
  3. When speaking in generic terms or when including women and men in the same group, some guides suggest alternating female and male pronouns: "A person should take good care of her car. He should check the oil level daily. She should also make sure that the tires are properly inflated."
  4. The indefinite use of the second person pronoun *you* to refer to people in general is a widespread conversational device. You must realize, however, that the use of the second person in writing creates an intimate relationship between the writer and the reader. For this reason, when you use the second person, be sure that the person or persons to whom the argument is directed is clearly identified.
  5. Masculine pronouns can be replaced by the impersonal pronoun *one* and this is still preferred in formal usage. However, one should use this form sparingly.

## III. Forms of Address

Traditionally there has been little need for particular ways to refer to individual women or married individuals with different titles. Women did not have titles other than "Miss" or "Mrs.," and it was assumed that their identity derived from their marital status. That assumption is no longer valid, and forms of address should recognize that identity which women have as individuals.

- A. In referring to an individual woman there is no need to refer to her marital status, just as traditional references to men give no indication of their marital status. Examples:
  1. Ms. Lorna Stafford
  2. The Reverend Ms. Louise Lind
  3. The Reverend Mr. Louis Lind
  4. Dr. Jennifer Jones
- B. Different titles should be recognized when addressing married couples. Examples:
  1. Clergywoman married to a layperson: The Reverend Ms. Sally Jones and Mr. Gerald Jones

2. Clergy couples: The Reverends Ms. Sally Smith and Mr. Gerald Jones; The Reverends M/M Sally and Gerald Jones
  3. Other titles: Professor Louise Lind and Dr. Jonathan Smith; Drs. Cynthia and Jackson Whittaker
- C. While the use of individual names is assumed when married people have different titles, this is desirable for others as well. Instead of Mr. and Mrs. Steve Jackson, try:
1. Steve and Lorna Jackson
  2. Mr. and Mrs. Steve and Lorna Jackson
  3. M/M Steve Jackson and Lorna Stafford
- D. Titles can be eliminated altogether, but in formal usage this practice is generally not preferred.

#### IV. References to Collective and Abstract Nouns

Social institutions (e.g., Church), concepts (e.g., evil), or inanimate objects (e.g., a ship) do not have gender. Referring to them as female or male encourages stereotyping groups of people with the qualities specific to that institution, concept, or object.

- A. Pronouns that refer to collective and abstract nouns should be neuter, except in direct quotations.
  1. Direct quotation: "And I saw the holy city, new Jerusalem, coming down out of heaven from God, prepared as a bride adorned for her husband. . . ." (Rev. 21:2).
  2. Modern usage: The Church is described as the new Jerusalem. It is adorned for the worship of God, and its relationship with God is seen as a gift from God.
- B. Direct quotations can often be made inclusive through the use of brackets: "A person must make his [or her] own way in this broken world."

### LANGUAGE ABOUT GOD

While these guidelines are designed mainly for use in terms of language about people, care and attention should be given also to language about God in writing, speaking, and in worship. Language about God should articulate the variety and richness of God's manifestations to humankind. It should also respect the deeply personal nature of God as expressed through the Trinity. These suggestions are offered as a beginning point from which one can develop androgynous language about God.

- A. The exclusive use of either masculine or feminine pronouns for God should be avoided.
- B. Metaphors showing God's personal relationship with humans should be used, but need not be personalized with "he" or "she."
- C. A variety of sex-specific metaphors can be used: "God is the father who welcomes his son home, but she is also the woman who searches for the lost coin."

Imagination, patience, and diligence are required in order to use language which expands and enriches our understanding of God.

## JUDICIAL PROCEDURES

### Duke Divinity School

Adopted January 1987, The Divinity School Community:

"Duke University expects and will require of all its students continuing loyal cooperation in developing and maintaining high standards of scholarship and conduct. . . . Any student, in accepting admission, indicates willingness to subscribe to and be governed by these rules and regulations and acknowledges the right of the university to take such disciplinary action, including suspension and/or expulsion, as may be deemed appropriate, for failure to abide by such rules and regulations or for conduct adjudged unsatisfactory or detrimental to the university."

[*The Bulletin of Duke University: The Divinity School: "Admissions-Conduct of Students"*]

The judicial system hereinafter described is constituted for the Divinity School Community as required by the Judicial System of Duke University and the university's rubric on Student Life. It conforms to and functions within those larger structures. [Reference will be made in this document to the most readily available specification of university rules, *The Bulletin of Duke University: "Information and Regulations"* which may be consulted in the office of either associate dean or in the Divinity School Library and obtained through the Office of Student Life of Trinity College. See sections on "Student Life" and Appendix entitled "The Judicial System of Duke University."]

### The Divinity School Judicial Board

The Divinity School Judicial Board [hereinafter simply "the board"] is composed of the two associate deans and five students (one of whom shall be designated an alternate) and three faculty or staff members (one of whom shall be designated an alternate). They shall be chosen respectively by the Student Representative Assembly and the Divinity School faculty through the normal procedures for constituting committees. The board is constituted at the opening of school in the fall; members serve until the opening of the next school year or until replaced by their respective governing bodies. At its first meeting, the board shall elect a chair from among its appointed and regular membership.

#### A. Hearing Alternatives.

Students accused of violating university regulations or academic expectations may elect either (1) an informal hearing in which the accused student and the accusing student, faculty member or staff member appear before the appropriate associate dean [see below] and the student's faculty adviser; (2) a formal hearing before the board according to procedures outlined below. (If the severity of the offence dictates or if procedural difficulties loom, the chair and associate dean may determine that a formal hearing is required or that higher university boards or civil courts must have jurisdiction.) (3) Under either option, the person accused may be advised by a person from within the Divinity School Community. The adviser may attend but may not speak during the hearing and will be excused during deliberation over verdict and sanctions.

#### B. Jurisdiction.

Matters concerning academic offences—cheating, plagiarism, theft of papers, library misconduct—shall be heard, formally or informally, by the associate dean for academic programs. Offences concerning student life, the university community, field education, or professional ethics shall be heard, formally or informally, by the associate dean for student life and field education.

#### C. Offences.

Among the academic offences deemed unacceptable at Duke University are plagiarism—the submission of work as one's own which contains unacknowledged or improperly acknowledged words or ideas of another—submission of papers in more than one course without the explicit permission of the instructors concerned,

the purchase or theft of papers, cheating and abuse of the library. Student life offences include abuse of university property, theft, falsification of financial aid applications, use of illegal substances and physical, mental or sexual harassment. For detailed specification and illustration of student life offences see the aforementioned *Bulletin: Information and Regulations* under "Student Life" and "University Regulations and Policies."

The same volume treats academic offences in the section entitled "Academic Honesty." Students are advised to purchase at the Duke University Bookstore the *Composition Guide*. . . *Duke University* by Ronald R. Butters which provides detailed guidance on correct procedure and clear illustrations of impermissible practice.

D. Duties of the Associate Deans.

The associate deans shall be responsible for hearing complaints, conducting investigations, gathering evidence, determining probable cause, establishing whether the Divinity School Board has jurisdiction, specifying the charge, informing the accused of his/her rights, indicating the hearing options, impaneling the board in the event of a formal hearing, preparing the case, setting the date for a hearing, producing witnesses and imposing any sanctions or penalties.

E. Formal Hearings.

- (1) If the student elects (or the associate dean specifies) a formal hearing, the associate dean with jurisdiction shall convene the board at the earliest possible point.
- (2) A faculty or student member shall disqualify himself/herself if he/she is otherwise involved in the case and the student charged may challenge the seating of a faculty or student member of the board (stating in writing the reasons for so doing). The chair (or in the event of a challenge to the chair, the associate dean) shall accept or reject the challenge. In the event of a disqualification of a member, the appropriate alternate shall be seated.
- (3) Hearings shall be closed. Formal hearings shall be recorded and the recording retained for a period of three years.

F. Hearing Procedures.

- (1) The rights of the accused and the hearing procedures outlined in sections I. "Role of Accused," and J. "Hearing Procedure," in the "Judicial System of Duke University," Appendix of *Bulletin: Information and Regulations* shall guide the associate dean and the adviser or the board in the conduct of a hearing (e.g. judgments of expulsion or suspension require concurrence of four of the five voting board members).
- (2) The board (or associate dean and faculty adviser) may impose the sanctions specified in the same Appendix singly or in combination (e.g. expulsion, suspension, probation, warning, fine, recommendation of counseling, etc.).

G. A person convicted may appeal his/her case to the Dean by providing written notice of that intention within 48 hours and a written statement of the grounds within 7 days of the receipt of the verdict. Grounds for appeal include new and significant evidence which might alter the case or violation of due process.



## ENROLLMENT SUMMARY 1988-89

### Divinity School Students, total 392

316	M.Div.	(210 men, 107 women)
15	M.R.E.	(3 men, 13 women)
19	Th.M.	(15 men, 4 women)
15	Special Students	(12 men, 3 women)
26	M.T.S.	(16 men, 10 women)

### Graduate Division of Religious Studies, total 80

80 Ph.D.

Total 471

## GEOGRAPHICAL DISTRIBUTION 1988-89

Alabama	7	Nebraska	1
Arizona	1	Nevada	1
Arkansas	1	New Jersey	2
California	2	New Mexico	3
Colorado	1	New York	5
Connecticut	2	North Carolina	188
Florida	17	Ohio	12
Georgia	7	Oregon	1
Idaho	1	Pennsylvania	14
Illinois	6	South Carolina	12
Indiana	2	South Dakota	1
Iowa	1	Tennessee	8
Kansas	2	Texas	7
Kentucky	4	Virginia	44
Louisiana	2	West Virginia	6
Maine	1	Foreign:	
Maryland	1	Bermuda	1
Massachusetts	2	Guyana	2
Michigan	1	Korea	2
Minnesota	2	Liberia	1
Mississippi	5	Scotland	1
Missouri	5	West Africa	1
Montana	2	West Germany	2

## Denominations Represented 1988-89

African Methodist Episcopal	4	Moravian Church in America	2
African Methodist Episcopal Zion	2	National Baptist	1
American Baptist Churches, USA	5	National Baptist Convention of America	1
Baptist	5	Nondenominational	4
Christian Church (Disciples of Christ)	2	Presbyterian	1
Christian Methodist Episcopal	3	Presbyterian Church in the USA	19
Church of Christ	1	Presbyterian Church of America	1
Church of God	1	Progressive National Baptist Convention	1
Church of God (Cleveland, TN)	2	Roman Catholic	3
Church of God in Christ	2	Southern Baptist	12
Church of the Brethren	2	Southern Methodist	1
Episcopal	17	Unitarian Universalist	1
Evangelical Lutheran	1	United Church of Christ	7
Evangelical Lutheran Church in America	2	United Holy Church of America	1
Evangelisch-Lutherisch	1	United Methodist	276
Guyana Missionary Baptist Church	1	Wesleyan	1
Mennonite Church	1	Unaffiliated	1

## Colleges Represented

Agnes Scott College	1	Appalachian State University	6
Albright College	1	Arizona State University	1
Allegheny College	1	Atlantic Christian	2
Alliance College	2	Auburn University	1
American Baptist Seminary	1	Augustana College	1

Averett College	3	High Point College	7
Baldwin-Wallace College	2	Hobart-William Smith	1
Bartlesville Wesleyan	1	Hofstra University	1
Baylor University	1	Houghton College	1
Berry College	1	Indiana University	1
Bethune-Cookman College	1	Iowa State University	1
Birmingham-Southern	3	Jacksonville State University	1
Bluefield State College	4	James Madison University	1
Boston University	2	Jarvis Christian College	1
Brevard College	1	Johnson Bible College	1
Bucknell University	1	Johnson College Smith University	1
California University of Pennsylvania	1	Kansas Wesleyan	1
California Polytechnic State University	1	Kearney State College	1
Campbell University	3	Kookmin University	1
Canisius College	2	Korea University	1
Carnegie-Mellon University	2	Kutztown University	1
Carson-Newman College	2	Lebanon Valley College	1
Case-Western Reserve University	1	LeMoyne College	1
Central Methodist College	1	Lenoir-Rhyne College	2
Central Wesleyan College	1	Livingstone College	2
Centre College	2	Longwood College	3
Clarion University	1	Lubbock Christian College	1
Clemson University	2	Lynchburg College	2
Cleveland State University	1	Malone College	2
College of New Rochelle	1	Manchester College	1
College of William & Mary	1	Marquette University	2
College of St. Rose	1	Mars Hill College	4
Columbia College	2	McKendree College	1
Concordia College	1	McMurry College	1
Cornell University	1	MCV/VCU	1
C.W. Post College	1	Meredith College	1
Detroit Institute of Technology	1	Methodist College	7
Dickinson College	2	Miami University	1
Duke University	6	Michigan State University	1
Earlham College	1	Middle Tennessee State University	1
East Carolina University	3	Mississippi State University	1
East Coast Bible College	1	Morehead State University	1
East Tennessee State University	1	Morehouse College	1
Eastern Mennonite College	1	MTSU	1
Eastern Michigan University	1	Nicholls State University	1
Edinboro University of Pennsylvania	2	North Carolina A&T State University	1
Eisenhower College	1	North Carolina State University	5
Elizabeth City State College	1	North Carolina Wesleyan University	5
Elon College	2	North Carolina Central	2
Emerson College	1	North Park College	1
Emory and Henry College	5	Oakland University	2
Emory University	1	Ohio Northern University	1
Empire State College	1	Ohio State University	1
Ewha Women's University	1	Ohio University	1
Fayetteville State University	3	Ohio Wesleyan University	1
Ferrum College	3	Old Dominion University	2
Florida A & M University	1	Oral Roberts University	2
Florida Atlantic University	1	Otterbein College	1
Florida Southern College	6	Park College	1
Francis Marion College	1	Pembroke State University	4
Gardner-Webb College	3	Pfeiffer College	8
George Mason University	2	Piedmont Bible College	1
Georgia Southern College	3	Purdue University	1
Goddard College	1	Radford University	1
Gordon College	2	Randolph-Macon College	1
Greensboro College	3	Rice University	2
Grove City College	2	Roanoke Bible College	1
Guilford College	2	Rochester Institute of Technology	1
Hampden-Sydney College	1	Southern Illinois University	1
Hampton University	1	Sangamon State University	1
Harvard University	1	Shaw University	2
Hendrix College	3	Simpson College	2

Sioux Falls College	1	University of Mississippi	2
Smith College	2	University of Missouri	1
Southern Illinois University	2	University of Montana	1
Southern Methodist University	1	University of New York	1
St. Andrews Presbyterian	1	UNC-Asheville	1
St. Augustine's College	1	UNC-Chapel Hill	19
St. Mary of the Plain	1	UNC-Charlotte	6
St. Olaf College	1	UNC-Greensboro	3
State University of New York	1	UNC-Wilmington	3
Stetson University	3	University of South Carolina	3
SUNY at Geneseo	1	University of Southern Florida	2
Sweet Briar College	1	University of Southern Mississippi	2
Tennessee Technological University	1	University of Tennessee	4
Tennessee Wesleyan College	2	University of Texas	1
Texas A & M University	1	University of Texas-Austin	3
Texas College	1	University of the South	1
Texas Tech University	1	University of Virginia	3
Texas Wesleyan College	2	University of Wyoming	1
Thiel College	1	Vanderbilt University	1
Trinity University	1	Vassar College	1
Tusculum College	1	Virginia Commonwealth College	1
Union College	1	Virginia Polytechnic Institute	1
University of Alabama	1	Virginia State University	2
University of Arizona	1	Virginia Wesleyan College	3
University of California-Davis	1	West Virginia Wesleyan College	8
University of California-Los Angeles	1	Wabash College	1
University of Central Florida	2	Wake Forest University	7
University of Colorado	1	Western Carolina University	4
University of Delaware	1	Western Michigan University	1
University of Erlangen	1	Western Virginia University	1
University of Florida	2	Wheaton College	1
University of Georgia	3	William and Mary	2
University of Idaho	1	William Jewell College	1
University of Illinois	3	Wilson Technical College	1
University of Indianapolis	1	Wingate College	1
University of Kentucky	1	Winston-Salem State College	3
University of Maryland	2	Wittenberg University	2
University of Massachusetts	1	Wofford College	1

### Colleges Represented—Graduate Degrees

Asbury Theological Seminary	2	Mississippi College	1
Ashland Theological Seminary	2	Moravian Theological Seminary	1
Boise State University	1	North Carolina Central University	1
California Polytechnic State University	1	North Carolina State University	1
Candler School of Theology	1	Presbyterian School of Christian Education	1
Church of God School of Theology	1	Purdue University	2
Denver Conservative Baptist Seminary	1	Roosevelt University	1
Duke Divinity School	10	Southeastern Baptist Theological Seminary	5
Duke University	2	Southern Illinois University	1
East Carolina University	1	St. Thomas University	1
East New Mexico University	1	Texas Wesleyan College	1
East Tennessee State University	1	Tulane University	1
Emerson College	1	University of Arizona	1
Florida Southern College	2	University of Bonn	1
Florida State University	1	University of Colorado	1
Fuller Theological Seminary	1	University of Illinois	2
Glasgow University	1	University of Kansas	1
Gordon-Conwell Theological	1	UNC-Chapel Hill	6
Hollins College	1	UNC-Charlotte	2
Kearney State College	1	UNC-Greensboro	3
Lutheran Theological Southern Seminary	1	Union Theological Seminary	1
Manchester College	1	University of Pittsburgh	1
Mennonite Biblical Seminary	1	University of South Carolina	1
Michigan State University	1	University of Southern California	2

Colleges Represented—Graduate Degrees (Continued)

University of Virginia	1	Western Carolina University	1
University of West Florida	1	Winthrop College	1
Virginia State University	1	Wright State University	1
Wake Forest University	3	Yale Divinity School	1
Walter F. George School	1		

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 Smith, Adolph C., (B.A., Methodist College), Jacksonville, North Carolina  
 Smith, Clarence A., (B.S., Texas College), Madison, North Carolina  
 Smith, David B., (B.S., Wake Forest University), Durham, North Carolina  
 Smith, Marsha D., (B.A., Sioux Falls College), Sioux Falls, South Dakota  
 Smith, Randolph W., (B.A., Concordia College), Eagan, Minnesota  
 Smith, Robert L., (B.A., Bluefield State College), Tazewell, Virginia  
 Smith, Samuel R., (B.A., Tusculum College), Durham, North Carolina  
 Solano, Michael J., (B.S., Auburn University), Montgomery, Alabama  
 Solberg, James M., (B.A., University of Illinois), Cary, North Carolina  
 Speed, Daniel G., (B.M.S., University of Southern Mississippi), Collins, Mississippi  
 Spence, Clinton W., (B.A., University of Georgia), Atlanta, Georgia  
 Spencer, Glenn M., (B.A., Elon College), Ramseur, North Carolina  
 Stahl, Jeannine L., (B.A., Rice University), Hawthorne, Nevada  
 Statler, Mark B., (B.M.E., Central Methodist College), Carothersville, Missouri  
 Stauth, Thomas D., (B.A., St. Mary of the Plain), Dodge City, Kansas  
 Stevenson, Scott A., (B.A., University of Southern Carolina), Summerville, South Carolina  
 Stewart, Robert W., (B.A., Mars Hill College), Roanoke Rapids, North Carolina  
 Stewart, Samuel L., (B.A., Winston-Salem State University), Winston-Salem, North Carolina  
 Stone, Lisa A., (B.A., Tennessee Wesleyan College), Fayetteville, Tennessee  
 Sweat, David A., (B.A., Baylor University), Chapel Hill, North Carolina  
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 Taylor, Linda L., (B.S., California University of Pennsylvania), Avella, Pennsylvania  
 Tennyson, John E., (B.A., University of Illinois), Champaign, Illinois  
 Thornton, David B., (B.A., Morehouse College), Columbus, Georgia  
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 Townsley, Robin J., (B.S., Kutztown University), Durham, North Carolina  
 Tyson, Bobby P., (B.A., North Carolina Wesleyan College), Laurel Hill, North Carolina  
 Vest, Roger A., (B.A., Berry College), Jonesboro, Georgia  
 Wanger, Stephen P., (B.A., Oral Roberts University), Kipling, North Carolina  
 Ward, June R., (B.S., Wayne Community College; B.A. Greensboro College), Greensboro, North Carolina  
 Warren, Donnie R., (B.S., Florida Southern College), Raleigh, North Carolina  
 Watford, Troy S., (B.A., Wofford College), Spartanburg, South Carolina  
 Watson, Wendelin J., (B.A., UNC-Chapel Hill), Chapel Hill, North Carolina  
 Weaver, James T., (B.A., Pembroke State University), Durham, North Carolina  
 Weaver, Nina C., (B.S., Appalachian State University), Warrensville, North Carolina  
 Welbaum, Barbara E., (B.S., Oakland University; M.S., University of Southern Carolina), Rochester Hills, Michigan  
 Wenger, Tracy L., (B.A., Lebanon Valley College), Quarryville, Pennsylvania  
 Wesley, John T., (B.A., Campbell College), Lexington, Kentucky  
 White, Jan L., (B.A., Texas Wesleyan College), Granbury, Texas  
 White, Robert D., (M.A., University of West Florida), Sun City Center, Florida  
 White, William M., (B.A., Hampden-Sydney College), Winchester, Virginia  
 Whitney, Saima L., (B.A., Virginia Wesleyan College), Virginia Beach, Virginia  
 Whittington, Ella J., (B.A., Livingstone College), Lenoir, North Carolina  
 Wickham, Charles W., (B.S., Averett College), South Boston, Virginia  
 Wike, Melissa H., (B.M., Lenoir-Rhyne College), Denver, North Carolina  
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 Wilson, John, III, (B.S., Florida A&M University), Newport News, Virginia  
 Wimberley, Richard E., (B.A., UNC-Chapel Hill), Raleigh, North Carolina  
 Wingo, Norma W., (B.A., Methodist College), Rougemont, North Carolina  
 Winright, Tobias Lee, (B.A., University of Southern Florida), Tarpon Springs, Florida  
 Wolfe, Lois A., (B.A., Florida Southern College), Hernando, Florida  
 Woodhouse, Andrea R., (B.A., Emory and Henry College), Elliston, Virginia  
 Woodhouse, David W., (B.S., UNC-Chapel Hill), Wilson, North Carolina  
 Woods, John C., (B.S., Georgia Southern College), Hinesville, Georgia



Woody, David S., (B.A., Emory and Henry College), Maryville, Tennessee  
Wright, Jeffrey W., (B.A., Emory and Henry College), Oxford, North Carolina  
Young, R. M., (B.A., Boston University), Springfield, Pennsylvania

### **Candidates for the Master of Religious Education Degree**

Buckley, Betty Ann, (B.A., Grove City College), Raleigh, North Carolina  
Cadle, Patricia J., (B.S., UNC-Greensboro), Burlington, North Carolina  
Collins, Renee, (B.A., Stetson University), Deland, Florida  
Cumbest, Sheila D., (B.S., University of Southern Mississippi), Pascagoula, Mississippi  
Erickson, Marja L., (B.A., High Point College), Rockville, Maryland  
Hewett, Benjamin J., (A.A., Lake City Community College; B.S., University of Florida), Fort White, Florida  
Lartey, Seth O., Wilson, North Carolina  
Lee, Virginia A., (B.A., College of William & Mary), DeWitt, Virginia  
Madariaga, Patricia H., (B.S., University of Florida; M.A.T., Winthrop College), Raleigh, North Carolina  
Markatos, Cathy M., (B.A., Vassar College), Pittsboro, North Carolina  
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Radosevic, Tracy A., (B.A., Grove City College), Canton, Ohio  
Serwer, Sheryl S., (B.A., Duke University), Chapel Hill, North Carolina  
Torres, Janet M., (B.S., Mississippi State University), Moss Point, Mississippi  
Triplett, Carlene R., (B.S., Union College; M.A., Purdue University), Bennettsville, South Carolina

### **Candidates for the Master of Theological Studies**

Bell, Thomas J., (B.M., University of Georgia; M.A., UNC-Chapel Hill), Jonesboro, Georgia  
Carr, Marjorie B., (B.S., UNC-Chapel Hill; M.D., UNC-Chapel Hill), Raleigh, North Carolina  
Christy, Jamye C., (A.A., Brevard College; B.A., UNC-Charlotte), Lexington, North Carolina  
Cooper, William K., (B.A., Wake Forest), Matthews, North Carolina  
Davis, Mary Margaret, (B.A., Wake Forest), Louisburg, North Carolina  
Elliott, Deronda E., (B.S., Marquette University), Raleigh, North Carolina  
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Freedman, Sarah S., (B.A., Allegheny College; M.A., University of Pittsburgh), Durham, North Carolina  
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Johnson, Bradley A., (B.A., St. Olaf College), Bloomington, Minnesota  
Jones, Charles B., (B.A., Morehead State University), Durham, North Carolina  
Lambert, William R., (B.A., Lubbock Christian College), Durham, North Carolina  
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Murphy, Debra D., (B.S., West Virginia Wesleyan), Marlinton, West Virginia  
Nation, Mark K., (B.A., Sangamon State University; M.A., Mennonite Biblical Seminary), Urbana, Illinois  
Peltier, Christopher J., (B.A., Gordon College), Williamstown, Massachusetts  
Radford, Claudia L., (B.A., Southern Illinois University), Raleigh, North Carolina  
Renalds, Douglas W., (B.A., Carson-Newman College), Mt. Sidney, Virginia  
Sturges, Harriette H., (B.A., Sweet Briar College), Louisburg, North Carolina  
Swenson, Kristina L., (B.A., University of Indianapolis), Durham, North Carolina  
Toole, David C., (B.A., University of Montana), Helena, Montana  
Whitmire, John T., (B.S., Jacksonville State University), Jacksonville, Alabama  
Williams, Elijah, (B.A., Fayetteville State University), Reidsville, North Carolina

### **Candidates for the Master of Theology Degree**

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Bevere, Allan R., (B.A., Malone College; M.Div., M.A., Ashland Theological Seminary), Seagrove, North Carolina  
Bevere, Matthew H., (B.A., Malone College; M.Div., M.A. Ashland Theological Seminary), Canton, Ohio  
Brown, Avery C., (B.S., M.Div., Texas Wesleyan College), Greensboro, North Carolina  
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Christy, Larry D., (B.A., East Coast Bible College; M.Div., Church of God School of Theology), Greensboro, North Carolina  
Crouch, Frank L., (B.A., UNC-Chapel Hill; M.Div., Moravian Theological Seminary), Durham, North Carolina  
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 Nagle, Daniel K., (A.A.S., Rochester Institute of Technology; B.A., North Park College; M.Div., Lutheran School of Theology of Chicago), Jamestown, New York  
 Sims, Timothy C., (B.A., UNC-Chapel Hill; M.Div., Lutheran Theological Southern Seminary), Lexington, South Carolina  
 Sinopoli, Kathryn L., (B.A., UNC-Chapel Hill; M.A., Wake Forest University), Winston-Salem, North Carolina  
 Whitten, Zenda A., (B.A., Columbia College; M.Div., Duke Divinity School), Durham, North Carolina  
 Wills, Gregory A., (B.S., Duke University; M.Div., Gordon-Conwell Theological Seminary), Memphis, Tennessee  
 Withrow, Lisa R., (B.A., Bucknell University; M.Div., Duke Divinity School), Glasgow, Scotland  
 Yearick, Carrie E., (B.A., Wingate College; M.Div., Duke Divinity School), Durham, North Carolina

## Special Students

Bassett, Lee S., (B.A., Cornell University), Cedar Grove, North Carolina  
 Blaisdell, Roger A., (B.A., Pembroke State University; M.Div., Denver Conservative Baptist Seminary), Halifax, North Carolina  
 Browne, Frances L., (B.A., Mars Hill College; M.Div., Southeastern Baptist Theological Seminary), Gadsden, Alabama  
 Clement, George A., Jr., (B.S., North Carolina State University), Cary, North Carolina  
 Denton, Mark S., (B.A., Mars Hill College; M.Div. Southeastern Baptist Theological Seminary), Advance, North Carolina  
 Ellis, Jerry D., (A.A.S., Wabash Valley Junior College; B.A., McKendree College), Fairfield, Illinois  
 Flynn, Mark R., (B.A., University of Tennessee; M.Div., Duke Divinity School), Knoxville, Tennessee  
 Hooper, Dennis E., (B.S., M.A., Western Carolina University; M.Div., Southeastern Baptist Theological Seminary), Clinton, North Carolina  
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 Jordan, Stephen R., (B.A., Central Wesleyan College; M.Div., Asbury Theological Seminary), Bennettsville, South Carolina  
 Lindquist, Carl W., (B.A., Thiel College; M.Div., Duke Divinity School), High Point, North Carolina  
 Muller, Markus, (University of Erlangen; University of Bonn), Dietersheim, Federal Republic of Germany  
 Pierce, Charlene H., (B.A., Campbell College; M.Div., Southeastern Baptist Theological Seminary), Fayetteville, North Carolina  
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*Freshman*

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*Seminars*

TRINITY COLLEGE OF ARTS AND SCIENCES

SPRING 1989

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The seminars described in this pamphlet are those approved and scheduled to be offered in the Spring 1989 semester. Trinity College and its academic departments reserve the right to make changes in announced offerings which may be required by staffing or other considerations. Students should consult the official Schedule of Courses for further information.

June 1988

*"Freshman Seminars, with a maximum of fifteen students in each class, provide significant opportunity for enhanced student-faculty interaction during the freshman year. These courses focus on subject areas across the curriculum and are taught by Duke faculty who have been chosen on the basis of their reputations as outstanding teachers and scholars. That the President of the University will be teaching a course this spring reflects the important contribution these seminars will make to the intellectual activities of the freshman year."*

RICHARD A. WHITE  
Dean of Trinity College  
Professor of Botany

## Trinity College Freshman Seminars

Small classes . . . lively discussion . . . a chance to pursue special interests instead of trying to "survey" the whole range of a topic or discipline . . . an opportunity to know well and to work closely with an experienced faculty member who is especially interested in sharing his or her intellectual interests with freshmen: these things and more are what Trinity College Freshman Seminars are all about. In registering for the Spring 1989 semester, Trinity College freshmen will be able to select from an unprecedented number of Freshman Seminars and an extraordinary range of seminar topics.

Freshman Seminars are open to all students enrolled in their first or second semester in Trinity College of Arts and Sciences. Offered by regular members of the teaching faculty and occasionally by distinguished emeritus professors, Freshman Seminars afford an opportunity for students to investigate intensively topics not ordinarily presented in introductory or survey courses. There is no prescribed format for seminars, but students should expect that, in general, seminars will differ from many other courses they have taken in several ways:

**Class size:** Faculty policy requires that seminars be limited to 15-18 students, and no faculty member may admit students to a seminar in excess of enrollment capacity.

**Emphasis on student participation:** Seminars are cooperative ventures, in which faculty members and students together investigate designated topics. All students are expected to participate fully in the work of the seminar, whether in discussion, research and investigation, or the preparation of original projects or reports. Conscientious preparation and absolutely regular attendance at seminar meetings are expected of all enrolled students, and freshmen should not elect any seminar if they anticipate the need for frequent absences or the need frequently to fall behind in class preparation.

**Scope:** Seminars do not attempt to "survey" a topic. Rather, students and faculty investigate some particular aspect of a topic or field. Students should not rely upon seminars to provide a broad factual background for advanced study in a given department or area.

Freshmen who have enrolled in seminars offered in past years are virtually unanimous in their praise of the seminar experience. "Absolutely the highlight of my freshman year" is a frequent comment. Freshman Seminars are not for everyone, and no student will be required to participate in the program. But for the student who values the chance to work closely with a faculty member on a topic of mutual interest, Freshman Seminars offer an opportunity unparalleled among lower-division courses in the Duke curriculum.

## Registration Procedure

With one exception, Freshman Seminars are open without prerequisite to Trinity College students in their first or second semester of enrollment. *Area designations within General Studies and class meeting times and places* will appear in the schedule of courses which will be available in the Pre-Major Advising Center approximately five weeks before the Fall registration period and from the Registrar ten days before the start of registration. When registration for a seminar requires the consent of the instructor, that consent must be obtained *directly from the faculty member concerned, before registration.*

Because of enrollment limitations, freshmen may register for only *one* Freshman Seminar. Students who hope to elect a seminar should list the seminar of their choice among their *primary* course selections for the spring term; seminars are not realistic options as "alternates" to any student's first four class choices. Seminars are designated by *department and course and section number*, and because all Freshman Seminars bear the common number 49S, it is especially important that the registration card bear the departmental designation ("French," "Psychology," etc.) rather than simply the notation "Freshman Seminar 49S."

General information about Freshman Seminars is available from staff members in the Pre-Major Advising Center. Information about *specific* seminars should be sought from the seminar faculty.



## FRESHMAN SEMINARS

AFRO-AMERICAN STUDIES 49S.01

### *Theater of Africa and the Caribbean*

This seminar focuses inquiry upon the ideas and philosophies of theater and drama within the African diaspora as well as those features which are distinctive from features of European theater. The drama and theater of African people will be studied for additional understandings of the struggles for hegemony in both political and social realities. Finally, in what might best be termed "social drama," the theater of African people is considered as illustrating features such as kinship ties, personal style, individual character, and symbols in human communication.

*Edward S. Hill, Ph.D. (Bowling Green State University), directs the Mary Lou Williams Center for Black Culture and teaches in the Department of English.*

ANTHROPOLOGY 49S.01

### *Social-Cultural Manifestation of Friendship*

This freshman seminar course will focus on the behavioral manifestations, culturally significant meanings, and overt and covert functions of the universal phenomenon of human bonding commonly identified in the English-speaking world by the label of "friendship." The various aspects of friendship in individual cultures will be examined and analyzed. Friendship will be compared to other types of human bonding such as marriage,

kinship, collegiality, membership in professional and other voluntary organizations, in order to highlight similarities and differences between them. Ethnographic, folkloristic, autobiographical and literary sources will be discussed to comprehend the interculturally diverse and complex nature of friendship in order to gain better insights into its causes and effects on individuals during their life cycles.

*Mahadev L. Apte, Ph.D. (University of Wisconsin), is a Professor of Anthropology whose special interests are sociolinguistics, Hindi, South Asian Languages and humor.*

ANTHROPOLOGY 49S.02

### *Animal Rights*

This seminar will consider the pros and cons of: using animals in medical research; the practices used with farm animals to increase production; keeping animals in zoos or captivity; and the use of animals for entertainment (racing, hunting, fighting). In the past few years, there has been increasing pressure from animal rights groups to halt the use of animals for biomedical research. There have been break-ins at labs around the world. One, at the University of Pennsylvania, produced videotapes of monkeys' injuries that resulted in the end of federal funding for that lab. New National Institutes of Health (NIH) guidelines for the treatment of lab animals were put into effect as of January 1986. Similarly, information about the production of high-priced veal dramatically increased public concern about the treatment of farm

animals. Seminar students will read several texts: Fox, *The Case for Animal Experimentation*; Singer, *Animal Liberation*; Harrison, *Animal Machines*.

*Matt S. Cartmill, Ph.D. (University of Chicago), is a Professor of Anatomy and of Anthropology.*

ANTHROPOLOGY 49S.03

## *Gandhi and Nonviolence*

The question of the role of the individual in cultural change is addressed through the history of Gandhi's non-violent resistance. A cross-cultural comparison with other versions of nonviolent or passive resistance, as, for example, Martin Luther King's, will also be made. Readings include autobiographical materials by Gandhi and King, which will undergo textual analysis in seminar session. Seminar participants will also present research papers on nonviolent resistance in practice.

*Richard G. Fox, Ph.D. (University of Michigan), is a Professor of Anthropology and is currently serving as Director of Undergraduate Studies in Cultural Anthropology.*

BOTANY 49S.01

## *The Darwinian Revolution*

Considers the many facets of one of the greatest upheavals in human thought. Topics include: historical antecedents of Darwin's theories; the scientific evidence for evolution

and natural selection; the impact of Darwinism on religion, social theory, and ethics; later scientific developments in genetics, statistics, ecology, and systematics that resulted in the so-called "modern synthesis" or NeoDarwinism; and recent challenges to the NeoDarwinian synthesis by latter-day creationists and by evolutionary biologists citing new and/or neglected data from paleontology, developmental biology, genetics, etc. The goal is to use these topics as an exemplar of scientific methods and change, and of the unsteady relationship between science and the public.

*Brent Mishler, Ph.D. (Harvard University), is an Assistant Professor of Botany with a special interest in bryology.*

BOTANY 49S.01

## *Biological Exploration in the Age of Discovery*

Readings and discussions will examine how the profound changes resulting from the biological and geographical explorations in the fifteenth to the twentieth centuries have influenced not only the way we think about ourselves and the world about us, but also such mundane matters as what we eat and wear and how we live. The expeditions, voyages, or conquests of Marco Polo, Columbus, da Gama, Magellan, Cortez, Pizarro, Coronado, Cook, Humboldt, Lewis and Clark, and Darwin as well as the lesser-known but equally significant efforts of Catesby, the Bartrams, the Michauxes, Pursh, Nuttall, Wilkes,

## FRESHMAN SEMINARS

and Pringle will be considered especially as to the impact of their discoveries upon biology and our lives.

*Robert L. Wilbur, Ph.D. (University of Michigan), former chairman of the Department of Botany, is well known for his research on flowering plants of the tropics.*

### CHEMISTRY 49S.01

## *Gender in Science*

Some would argue that science is gender-blind and that discrimination on the basis of sex does not exist. Others have quite different experiences and perceptions. Some would argue that scientific models of reality are products of gender bias. Others disagree. Case studies of scientific biographies (e.g., the Curies), scientific institutions (e.g., the Nobel Prize), and episodes of scientific change (e.g., the elucidation of the structure of DNA) will be examined as they pertain to these issues. Seminar discussions of out-of-class readings, brief student presentations of directed library research, and guest speakers will address these topics further. Some background in chemistry and physics will be helpful but not essential.

*Charles Lochmuller, Ph.D. (Fordham University), is a Professor of Chemistry whose special areas of interest are separations and surface spectroscopy.*

### COMPARATIVE LITERATURE 49S.01

## *The Poetics of Thought*

The seminar examines some of the ways in which literary discourse has been used as a vehicle of philosophical thought and philosophy in turn has been conceived and undertaken as a form of literature from antiquity to the twentieth century. Readings include the Book of Job, Plato's *Symposium*, Dante's *Inferno*, Novalis's *Hymns to the Night*, Dostoyevsky's *Notes from Underground*, Nietzsche's *Thus Spoke Zarathustra*, and Camus's *The Fall*. The course will be conducted throughout as a seminar, with primary emphasis on student participation in (and occasional direction of) the analysis and discussion of the texts.

*Michael Morton, Ph.D. (University of Virginia), is a member of the Department of Germanic Languages and Literature whose special interests include Goethe, Nietzsche and Herder.*

### DRAMA 49S.01

## *Chinese Art and Theater Design*

The social, philosophic, and artistic context of mainland Chinese visual arts and their relationship to theater design art. Course material is examined from an historical point of view as well as that of contemporary practicing theater artists.

*Wenhai Ma, M.F.A. (Carnegie-Mellon University), an artist-in-residence at Duke Drama, is an award-winning theater*

*designer who regularly teaches at the Central Academy of Drama in Beijing, People's Republic of China.*

DRAMA 49S.02

## *Dreams and Theater/Film/TV*

A study of parallels between dreaming and viewing theater/film/TV events with respect to mental and physiological factors. The state of the dreamer and the state of the viewer are similar: investigation of the similarities may reveal why viewing theater/film/TV is the single most common activity engaged in by people today. The seminar's thesis is the possibility that the roots of the need to watch are inherent and physiological, possibly based on mechanisms of central importance to the evolution of the species.

*David Ball, Ph.D. (University of Minnesota), director of the Duke Drama program and a writer whose work has been seen across the country and abroad, has assembled a world-class drama faculty. He is currently writing for off-Broadway and producing Duke Drama's first feature films.*

DRAMA 49S.03

## *The Masks of Modern Comedy*

On stage or screen, from Bernard Shaw to Woody Allen, whether the classic mask shows a wry smile or a boffo laugh—in comedy of social purpose, high comedy or low, satire

or tragi-comedy farce or theater of the absurd—comedy goes its irreverent way toward the aim of Prologue in Machiavelli's *Mandragola* ". . . to make the hour less bitter than it seems." Some of the playwrights of the age of comedy ushered in by Shaw: Oscar Wilde, Anton Chekhov, Noel Coward, J.M. Synge, Samuel Beckett, Eugene Ionesco, Tom Stoppard, Harold Pinter, Philip Barry, Robert Sherwood, Neil Simon; and on screen the great clowns: Charlie Chaplin, Buster Keaton, the Marx Brothers, Zero Mostel. And amidst this medley of inspired fools the student will concentrate, in class discussion and papers, on the changing expressions of the masks of comedy as created by the authors and interpreted by the performers.

*Kenneth J. Reardon, A.M. (Boston University), famous among generations of students for his acting ability and teaching, is an emeritus professor in the Department of English.*

DRAMA 49S.04

## *Theater of Africa and the Caribbean*

See listing under Afro-American Studies 49S.01. Students may register for this seminar, which is cross-listed as Afro-American Studies 49S.01, Drama 49S.04, or English 49S.02.



## FRESHMAN SEMINARS

ECONOMICS 49S.01

### *The New Economics in the Soviet Union, China, and Eastern Europe*

This seminar examines the radical changes in economic philosophy and practice which are occurring in the U.S.S.R. and Eastern Europe. Special attention is devoted to the economic implications for the United States and the rest of the world of the integration of China and the U.S.S.R. into the global economy.

*Thomas H. Naylor, Ph.D. (Tulane University), one of Duke's most respected economists, predicted in 1982 that the Soviet Union would move toward drastic reform of its economy. He is the author of The Gorbachev Strategy, scheduled for publication later this year.*

EDUCATION 49S.01

### *Introduction to Specific Learning Disabilities*

An examination of current theories regarding specific learning disabilities; characteristics of individuals; diagnostic procedures; psychological and educational treatments for individuals and their families.

*Lucy T. Davis, Ed.D. (Columbia University), chairs the Education Program and is active in educational outreach programs in the Durham city and county school systems.*

EDUCATION 49S.02

### *Discovering Childhood*

Where have all the children gone? In our high tech world, young children are pushed to "grow up" too fast. How different it was in the old days—or *was* it? This seminar presents a cross-disciplinary look at the concept of childhood, including historical, education, sociological, and psychological perspectives on the early years of life (birth to age 8). Childhood as depicted in art and literature, the "hurried" child of the '80s, and children and the media are some of the areas explored.

*Mary Mayesky, Ph.D. (Wayne State University), a former principal and assistant principal has written several textbooks in the areas of infancy, early childhood and primary education. She serves on the North Carolina Day Care Commission and on the Wake County School Board.*

ENGLISH 49S.01

### *The Masks of Modern Comedy*

See listing under Drama 49S.03. Students may register for this seminar, which is cross-listed as Drama 49S.03 or English 49S.01.

ENGLISH 49S.02

### *Theater of Africa and the Caribbean*

See listing under Afro-American Studies 49S.01. Students may register

for this seminar, which is cross-listed as Afro-American Studies 49S.01, Drama 49S.04, or English 49S.02.

ENGLISH 49S.03

## *The American Character*

The question "Is the American character distinctive?" will be examined through focus on four or five topics such as the reaction to World Wars I and II, the passage from adolescence, attitudes toward the elderly, the sense of shared community, and humor. Readings will be drawn from short fiction, both American and (in translation) German, Polish, and French. In-class reports and a seminar paper.

*Louis J. Budd, Ph.D. (University of Wisconsin), James B. Duke Professor of English, is one of the nation's best-known scholars of Mark Twain.*

ENGLISH 49S.04

## *Two Hundred Years of Romance*

This seminar will examine women's romantic fiction from Ann Radcliffe's *The Mysteries of Udolpho* (1794) to the current romance on *The New York Times* best-seller list in the spring of 1989. Seminar discussion will emphasize, for each of eight romances, the craft of the novel and the feminist issues at stake in the portrayal of the central love relationship. We will cast these discussions against a backdrop of critical studies of women's romantic fiction.

*Julie Tetel, Ph.D. (University of North Carolina at Chapel Hill), teaches linguistics in the Department of English. She is also a popular author of romance novels.*

ENGLISH 49S.05

## *Jewish-American Literature: Old Worlds and New*

It has been said that the hyphen in "Jewish-American" is the cutting edge of a sharp sensibility. In this seminar we will trace the realities of being Jewish in America from the late 1800s to the present, through readings in fiction and nonfiction and through films based on Jewish-American novels. We will explore such topics as the influence of Yiddish on American life and art, the evolution of the "Jewish mother" stereotype, the immigrant experience, assimilation and acculturation, the schlemiehl in modern fiction, and more. Above all, we will read and discuss some very good literature. Authors to be studied include, but are not limited to, the household names of Philip Roth, Bernard Malamud, Saul Bellow, and Joseph Heller, along with such less well-known writers as Henry Roth, Abraham Cahan, Michael Gold, and Anzia Yezierska.

*Judith Ruderman, Ph.D. (Duke University), is Director of Continuing Education at Duke. She has published on several modern authors and is currently writing on Joseph Heller. As a cantor, she sings a mean rendition of "My Yiddishe Mama."*

ENGLISH 49S.06

## *The Vietnam War in Film and Fiction*

This seminar will examine a confusing and controversial chapter in our recent history, the Vietnam War. Viewing the War primarily from the perspectives of American writers and filmmakers, we will consider the central problem with which they have had to contend: how to make sense of, indeed, how to "create" sense from, an experience so resistant to traditional interpretation and understanding. We will begin the course by reading and viewing relatively straight-forward realistic narratives. After we have a foothold in the more traditional manner of depicting war, we will investigate films and novels that dwell upon the paranoid and hallucinatory—works, in other words, that incorporate elements of the fantastic or grotesque. A small amount of lecture time will be devoted to the literary-historical content of the particular work under discussion, but the class hours will concentrate mainly on discussion of the assigned films and readings. Students are expected to prepare a seminar paper or equivalent project.

*Dale Jones, Ph.D. (University of Wisconsin), has published on American writers and on the fiction of the Viet Nam War. Major Jones teaches in the Department of Military Science.*

FRENCH 49S.01

## *Theatricality: French Theater*

This seminar is designed to introduce students to the basic elements of theatrical performance: the nature of the actor's work, the situation of the audience, the relationship between text and performance, the relationship between the director and the author, theatrical space, etc. Texts by representative French theater theoreticians will be read in combination with plays which will be viewed in video format. The accent will be upon the practical problems involved in producing dramatic texts.

*David F. Bell, Ph.D. (Johns Hopkins University), former resident director of the Duke in France program, is an authority on nineteenth and twentieth century French literature.*

GEOLOGY 49S.01

## *Earth — Rock*

An introduction to the basic concepts of earth crust as a framework for discussing the locations of various rocks and minerals. This background will permit consideration of the environmental, economical, and political consequences of the uneven distribution of rock-related resources on the face of the earth. The emphasis will be on the role of these resources in industry, the military, and the everyday life of students. A large number of slides and props will be used to illustrate geological features and to stimulate discussion.

*Jeffrey A. Karson, Ph.D. (State University*

## FRESHMAN SEMINARS

of New York, Albany), a structural geologist in the Department of Geology, gains insight into the evolution of rifts and transform faults, mapping projects in conjunction with Project Probe's seismic surveys in the East African Rift System.

GERMAN 49S.01

### *Reformation and Resistance: Protestant Resistance to Tyranny from Martin Luther to Adolf Hitler*

Examination of the conceptions of Luther, Calvin and other reformers about the resistance to government, and the relationship between religion and society and church and state. Consideration of resistance of their 20th century Protestant successors to National Socialism. Readings of historical sources in English translation and viewing of documentaries on the resistance movements in Nazi Germany.

*Christa T. Johns, Ph.D. (Free University of West Berlin), is a member of the Department of Germanic Languages and Literature with an interest in Reformation Studies. She is also Associate Director of the Duke University Summer Session and Administrative Director of the Duke in Berlin Program.*

GERMAN 49S.02

### *Berlin: From Monarchy to Democracy*

The city of Berlin considered as the focal point of cultural developments in

Germany since 1871: emphasis on the emperors, the "Golden Twenties" in art and literature (expressionism, Döblin, Brecht), the rise of National Socialism, the effect of World War II, the new beginnings in 1945, the ramifications of the divided city. Readings in historical sources and literary works, films (documentaries and film versions of literary works), discussions.

*Anette Koepfel, Ph.D. (University of North Carolina, Chapel Hill), teaches in the Department of Germanic Languages and Literature and has written on the Middle Ages and the short stories of Thomas Mann.*

GERMAN 49S.03

### *Years of Creativity: German Culture, Art, and Design between World War I and the Third Reich*

For those interested in modern Germany and who want to learn about one of the most influential movements of twentieth century art, crafts, and architecture in the context of the cultural history of Germany in the 1920s—revolutionary in its time and controversial today. Sources of the Bauhaus, its ideas, objectives, most important representatives, and transplantation to American shores.

*Margaret Kentgens-Craig, M.A. Art History and German (University of Bochum), teaches in the Department of Germanic Languages and Literature. She assisted the curator for the exhibit "Dutch Art in the Age of Rembrandt" at the North Carolina Museum of Art.*



## FRESHMAN SEMINARS

HISTORY 49S.01

### *Modern World Environmental History*

This seminar explores the accelerating effects of human activity on the biosphere, oceans, and atmosphere. We will try to put the environmental effects of human actions into an historical context. The scale of human activity has increased steadily since 1700. Rapid technological change has provided the means for the development of a world economy and increasingly larger and more effective nation-states. The result has been that environmental impacts have also moved from a limited local and regional focus to become global in their effects. In the seminar, we will be trying to think in terms of a global frame of reference and in terms of the past three centuries of human history. To do this, we will have to oscillate between a broad overview of human history and specific cases and examples to illustrate the processes with which we are concerned. The basic issue to be addressed is the apparent contradiction between legitimate human needs for economic development and the effects on the natural environment of that development.

*John F. Richards, Ph.D. (University of California, Berkeley), a member of the Department of History, is a leading researcher on the economic effects of global deforestation.*

HISTORY 49S.02

### *The Jews of Russia and Eastern Europe in Modern Times*

This seminar will explore the development of Russian and East European Jewry over the past two centuries, that is from the Polish partitions to the present day. Particular attention will be given to the conflicting attractions of secularism and the religious community, as well as socialization within and alienation from the broader societies in which Russian and East European Jews lived. We will also examine the problems of contemporary observers in evaluating the historical experience of Jews in Russia and East Europe.

*Warren Lerner, Ph.D. (Columbia University), is currently Chair of the Department of History and is a recognized authority on Communism and Socialism.*

HISTORY 49S.03

### *Emerging Society and Culture: Urban Britain, 1760-1914*

Using cities as a focal point for periodization, this seminar will investigate social patterns from a cultural perspective, using artistic, literary, and musical sources. Beginning in Beau Nash's Georgian Bath, scene of Richard Sheridan's *The School for Scandal*, students will explore the emergence of a new mass society. Further travels will include Preston, inspiration for Charles Dickens's *Hard Times*, Brighton

and the Royal Pavilion, Dublin, and finally London, renowned for the fast-paced living of Bloomsbury and the squalor of the East End. Students will make presentations during the second half of the course and will be expected to submit one research paper of moderate length.

*Sharon S. Grimes, Ph.D. (Duke University), is a British Historian who teaches Western European History. Her special interest is in the development of British Social Policy, specifically the National Health Service. She is an Assistant Director of the Pre-Major Advising Center.*

MATHEMATICS 49S.01

## *Number Theory and the Theory of Infinite Sets*

The objective of this seminar is to introduce students to two branches of mathematics: number theory and the theory of infinite sets. The seminar will include a study of the lives of major contributors, namely, Fermat, Euler, Lagrange, Gauss, and Cantor.

*Richard E. Hodel, Ph.D. (Duke University), a mathematician, is working on problems in cardinal functions, a major area of research in set-theoretic topology.*

MATHEMATICS 49S.02

## *Applications of Mathematics to Physiology and Medicine*

A variety of topics in mathematical physiology will be considered including the heart and circulation, control of cell volume, the functioning of the kidneys, and properties of neurons and the Hodgkin-Huxley equations. *PREREQUISITE: Mathematics 32 or 41, or by permission of the instructor, the equivalent.*

*Michael Reed, Ph.D. (Stanford University), professor and chairman of the Department of Mathematics, works on research problems in both pure and applied mathematics.*

MUSIC 49S.01

## *Music, Revolution, and War, 1789-1918*

While we appreciate musical masterpieces for their aesthetic values and the pleasure they give us, we often neglect the context for which they were written. From Old Testament times well into the nineteenth century, music was credited with the capacity to influence. How did those in authority attempt to harness the power of music? How did composers address contemporary social and political concerns as well as artistic ones? To consider these issues, we shall examine music's role at moments of crisis during the period 1789 to 1918 and attempt to see it through contemporaries' eyes. Among the

topics are: the French Revolution and music, Napoleon and Beethoven, Wagner, and American music during World War I. There are weekly listening and reading assignments (emphasizing primary sources—newspapers, memoirs, letters, official statements as well as the music itself). All students will participate in discussions, give short oral presentations and write a paper.

*M. Elizabeth C. Bartlet, Ph.D. (University of Chicago), is an Assistant Professor of Music with special interest in opera, French, 16th, 17th and 18th Century and Renaissance Music.*

MUSIC 49S.02

## *The History and Practice of Musical Criticism*

A history of criticism, taste, and period attitudes in various kinds of music (classical and popular) with regular practical assignments (reviews of live performance and recordings). The level will be set according to the musical background of students enrolling in the seminar. Particular study will be made of the great composer-critics of the past, some of whom (Berlioz, Schumann, Debussy) serve as models of musical journalism at its best.

*Bryan Gilliam, Ph.D. (Harvard University), a member of the Department of Music, is a performer and music theoretician who has professional interests in the music of Richard Strauss.*

PHILOSOPHY 49S.01

## *Aesthetics: The Dance*

Dance seen from a philosopher's point of view. We examine what is involved in deciding whether something is or is not dance; the forms and aspects of dance in art and life; dance and its relation to its neighbors (such as work, sport, and games); the ways in which dance can be found meaningful. We ask and try to understand why dance has played so little part in traditional philosophies of the arts, and why these philosophies of the arts take the form they do. Selected readings and film. Student reports and papers. Principal text: F. E. Sparshott, *Off the Ground*.

*Paul Welsh, Ph.D. (Cornell University), is now Professor Emeritus of Philosophy. His areas of specialization include aesthetics, philosophy of mind, ethics and logic.*

POLITICAL SCIENCE 49S.01

## *Turning Points in American Political Thought*

The way Americans think about government has not remained constant over time. From their renouncement of Britain at the outset, to their embracement of a broad suffrage, to their redefinition of the Union, to their acceptance of a "welfare" state, to their enthusiasm for Reagan's ideas of retrenchment and devolution, Americans have made a number of sharp turns in their thinking.

The seminar will explore these and possibly other turns. Readings will include: pre-Revolutionary writings of English and American thinkers, including Locke, John Wise, James Wilson, Alexander Hamilton, and John Adams; writings of Thomas Jefferson, Andrew Jackson, and Alexis de Tocqueville; debates on the nature of the Union—Webster, Lincoln, Roger Taney; authors of the Gospel of Social Justice, Progressivism, and New Freedom, and the New Deal; and contemporary analyses of the impact of the Reagan Presidency. Arthur M. Schlesinger's *The Cycles of American History* will serve as a starting point. Members of the seminar will be assigned basic readings but will be expected to find supplemental support or opposition to the points of view expressed therein. They will comment on their readings both in writing and orally at appropriate seminar meetings.

*Richard Leach, Ph.D. (Princeton University), is a Professor of Political Science whose area of special interest is American politics, federalism and political theory.*

POLITICAL SCIENCE 49S.02

## *Politics and Decision Making*

This seminar addresses some of the most prominent problems, methods, ideas, and findings that have emerged in recent theoretical studies of politics. Participants will examine intellectual puzzles, speculative models, and normative and explanatory applications. Models of decision theory, game theory, and social choice theory

will be presented as they apply to political contexts ranging from voting in small groups to candidate competition in mass elections.

*Emerson Niou, Ph.D. (University of Texas at Austin), is a member of the Political Science faculty and has special interest in Normative Theory, Game Theory and International Balance of Power.*

PSYCHOLOGY 49S.01

## *Freshman Seminar in Psychobiology*

A study of the biological basis of human behavior in health and diseases such as anorexia nervosa, drug abuse, alcoholism, depression, schizophrenia, and mania. Films, videotapes, student presentations, and literature reviews will be used. The seminar is designed for students with little background in psychology or the literature.

*H. Keith H. Brodie, M.D. (Columbia University), President of Duke University and James B. Duke Professor of Psychiatry, is an enthusiastic teacher and internationally respected researcher on the biological aspects of mental illness.*



PSYCHOLOGY 49S.02

## *The Language of Dreams*

Dreams and dreaming, once the subject of an arcane art, have in this century been brought under scientific scrutiny, earlier by Freud with his psychoanalytic method; more recently by investigators in laboratories following the watershed discovery in the mid-fifties that the eyes move rapidly at regular intervals during sleep and that these intervals mark episodes of dreaming. This seminar through readings, discussions, and work on raw data will examine certain issues—theoretical, procedural, empirical—that have been focal to this area of research. Special attention will be directed toward general issues in psychological investigation, such as reliability and validity, and to the relation of data to theory.

*Irwin Kremen, Ph.D. (Harvard University), teaches in the Psychology Department at Duke and has special interest in personality theory and visual art.*

PUBLIC POLICY STUDIES 49S.01

## *School Reform as Social Policy*

This seminar will be on education policy and will focus on the effect of public elementary and secondary schools on the distribution of government benefits and the distribution of income. Topics will include: the economic model of education, the importance of education in economic growth, other social uses of education, empirical work on the

effect of schools on achievement and other desirable outcomes, the current school reform movement, school desegregation as a federal policy, private school enrollment and politics affecting the financing of private schools, and the special problems faced by central city school systems. There will be a research paper in the seminar, drawing either on individual projects on city school systems of students' choice, or a collective effort on the question of school consolidation in Durham County.

*Charles T. Clotfelter, Ph.D. (Harvard University), is a member of the Economics and Public Policy Studies faculties. His primary area of interest is Public Finance and Social Policy.*

RELIGION 49S.01

## *The Belief Structure of Recent Jewish Fiction*

This seminar will examine fiction by four writers—Elie Wiesel, Isaac Bashevis Singer, Bernard Malamud, and Philip Roth—in order to determine the role in their work of beliefs concerning the conditions of human life, personal identity in relation to cultural conflict, history and human time, and values as shared either with members of a community or with those outside it. In addition to texts by these writers, several essays concerning Jewish life and thought in the post-holocaust period will be studied.

*Wesley A. Kort, Ph.D. (University of Chicago), a Professor of Religion, teaches courses which relate religion and modern literature.*

SOCIOLOGY 49S.01

## *Biotechnology and Society*

This seminar will focus on the impact of biological science, particularly of modern innovations in bioengineering and human reproduction and disease control, on aspects of human individuals' lives including family life cycles, longevity patterns, and gender identities. Such technologies as *in vitro* fertilization, male contraceptives, genetic engineering, and organ transplantation will be considered in their social implications.

*Angela O'Rand, Ph.D. (Temple University), a vibrant undergraduate teacher, is a member of the Department of Sociology with research interests in the sociology of science and gerontology.*

ZOOLOGY 49S.01

## *Beasts and Us*

This seminar examines differences in attitudes towards animals as a function of history, culture, gender, and age. In the United States, the majority of hangers-on at stables are female, while in Germany the ex-ratio, at least of young adults, is near unity;

we are inclined to cuddle puppies while many Indian Hindus shun them. How do biological, cultural, and historical factors account for these and other differences in our attitudes and interactions with animals? We will search out and examine studies that shed light on these questions and attempt to write a review summarizing what we learn.

*Peter H. Klopfer, Ph.D. (Yale University), a member of the Zoology faculty, enjoys an international reputation for his studies in animal behavior.*

ZOOLOGY 49S.02

## *The Physical World of Organisms*

How physical phenomena determine the consequences of the evolutionary process. Each student will be given a phenomenon or principle plus a set of references and other material with which to get started, and will then attempt to become an expert on identifying places where the phenomenon or principle is active.

*Steven Vogel, Ph.D. (Harvard University), a popular teacher, is a zoologist known for his studies of how animals and plants adapt themselves to the basic physical laws that govern the world.*







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